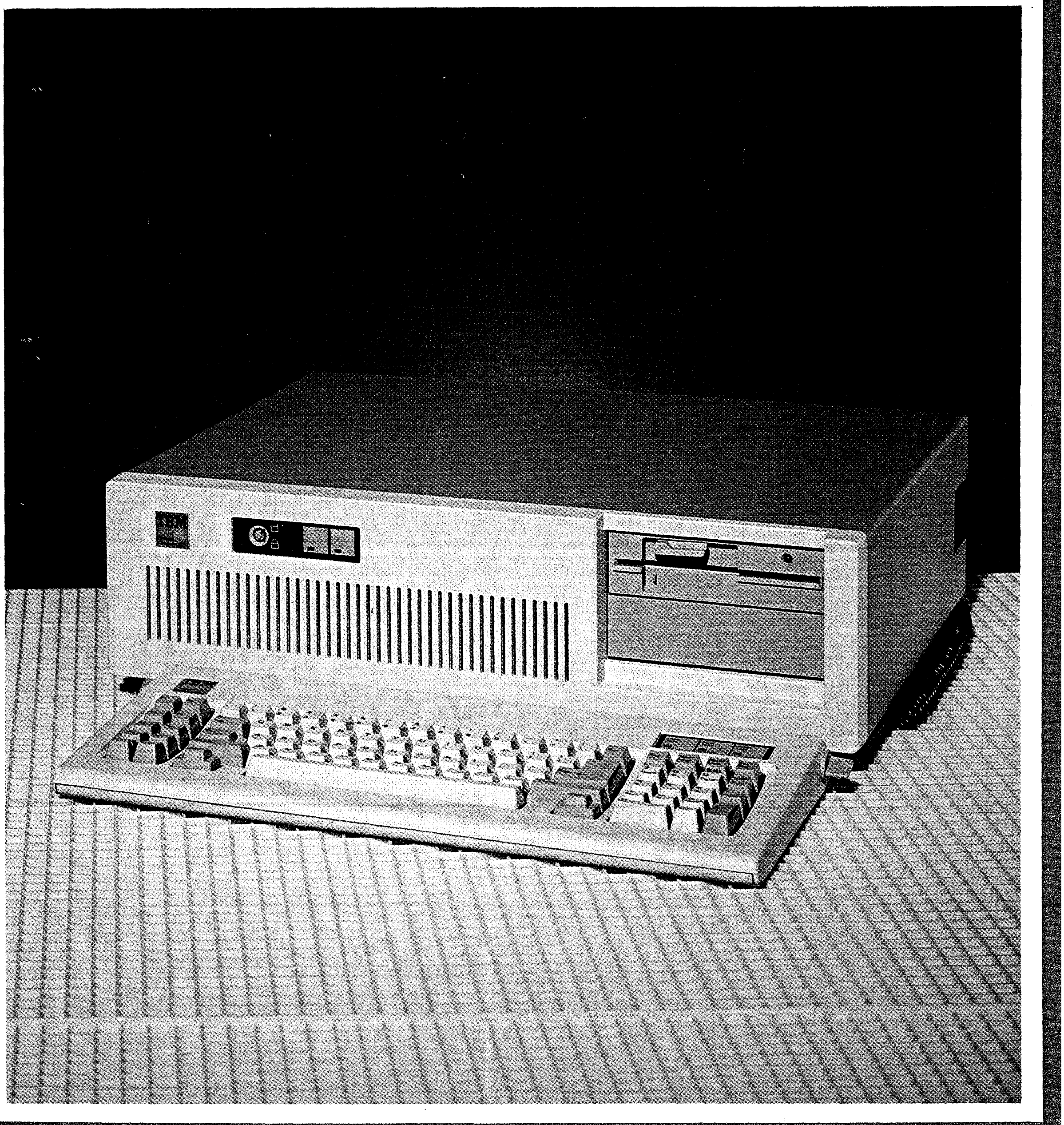
74

HOWARD W. SAMS & COMPANY CSCS17 08995

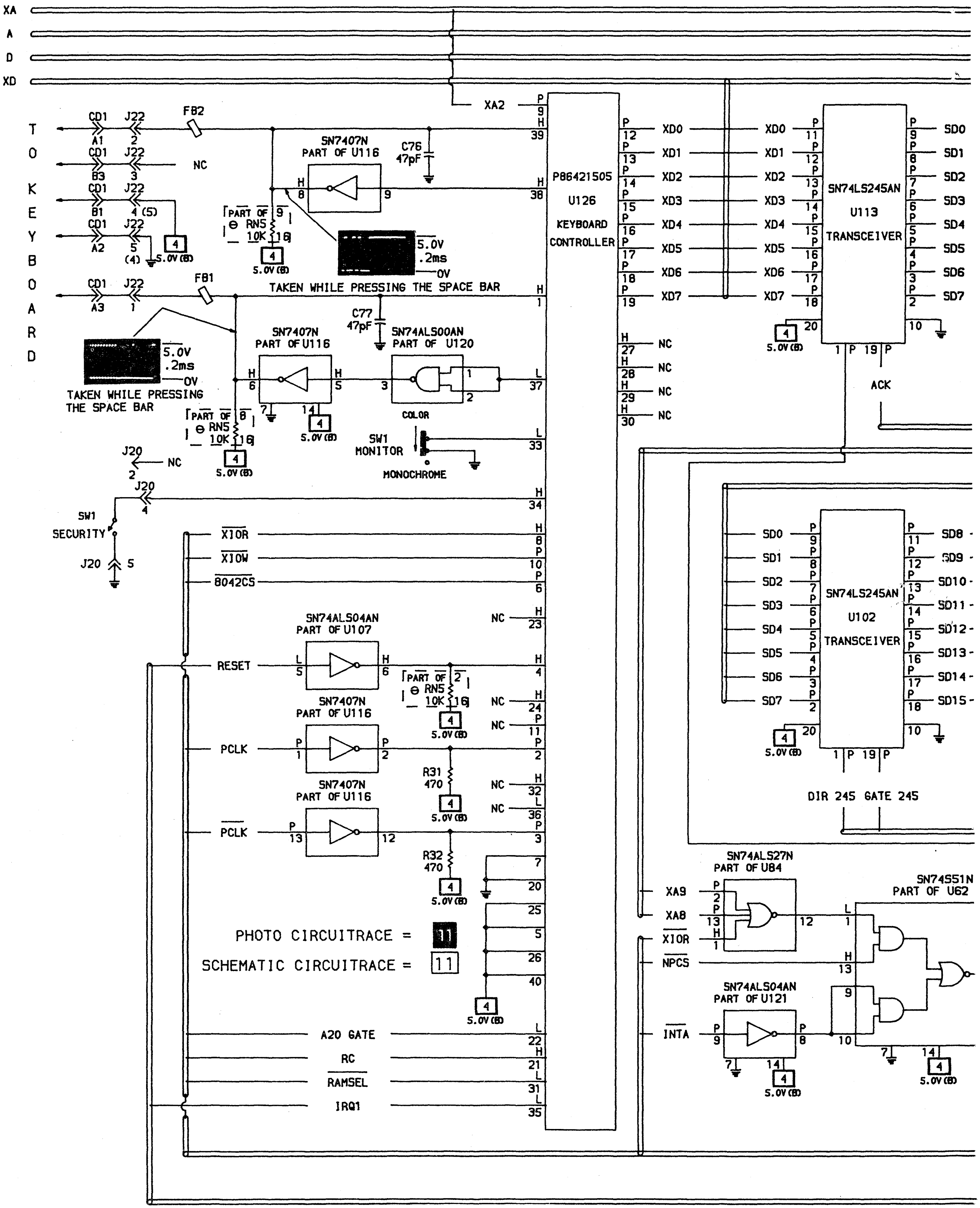
COMPUTERFACTS™

Technical Service Data

IBM® PC/AT
MODEL 5170-239
COMPUTER



FEATURES COMPLETE SCHEMATICS • PRELIMINARY SERVICE CHECKS • TROUBLESHOOTING TIPS •
EASY-READ WAVEFORMS • REPLACEMENT PARTS LISTS • SEMICONDUCTOR CROSS-REFERENCE


XA
A
D
XD
XA2
TO KEYBOARD
CD1 J22 FB2
A1 2
B3 3
B1 4 (5)
A2 5 (4)
A3 1
FB1
NC
5.0V (B)
SN7407N PART OF U116
C76 47pF
PART OF 9 RN5 10K 16
5.0V .2ms 0V
TAKEN WHILE PRESSING THE SPACE BAR
C77 47pF
SN7407N PART OF U116
SN74ALS00AN PART OF U120
PART OF 8 RN5 10K 16
COLOR
SW1 MONITOR
MONOCHROME
J20
SW1 SECURITY
P86421505
U126
KEYBOARD CONTROLLER
XD0
XD1
XD2
XD3
XD4
XD5
XD6
XD7
SN74LS245AN
U113
TRANSCEIVER
SD0
SD1
SD2
SD3
SD4
SD5
SD6
SD7
ACK
XIOR
XIOW
8042CS
SN74ALS04AN PART OF U107
RESET
PART OF 2 RN5 10K 16
SN7407N PART OF U116
PCLK
R31 470
SN7407N PART OF U116
PCLK
R32 470
U102
SD8
SD9
SD10
SD11
SD12
SD13
SD14
SD15
DIR 245 GATE 245
SN74ALS27N PART OF U84
XA9
XA8
XIOR
NPCS
SN74S51N PART OF U62
SN74ALS04AN PART OF U121
INTA
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
A20 GATE
RC
RAMSEL
IRQ1

A PHOTOFACT STANDARD NOTATION SCHEMATIC

WITH CIRCUITRACE

SAMS COMPUTERFACTS™

IBM PC/AT
MODEL 5170-239

ENHANCED GRAPHICS ADAPTER

See Folder CSCS17-A

FIXED DISK/FLOPPY DISK ADAPTER
FLOPPY DISK DRIVE

See Folder CSCS17-B

KEYBOARD, POWER SUPPLY, SERIAL/PARALLEL ADAPTER, SYSTEM BOARD

IBM PC/AT
MODEL 5170-239
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MODEL 5170-239

SAFETY PRECAUTIONS

See page 54.

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SAMS™ **Howard W. Sams & Co.**
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87CS14998 DATE 5-87

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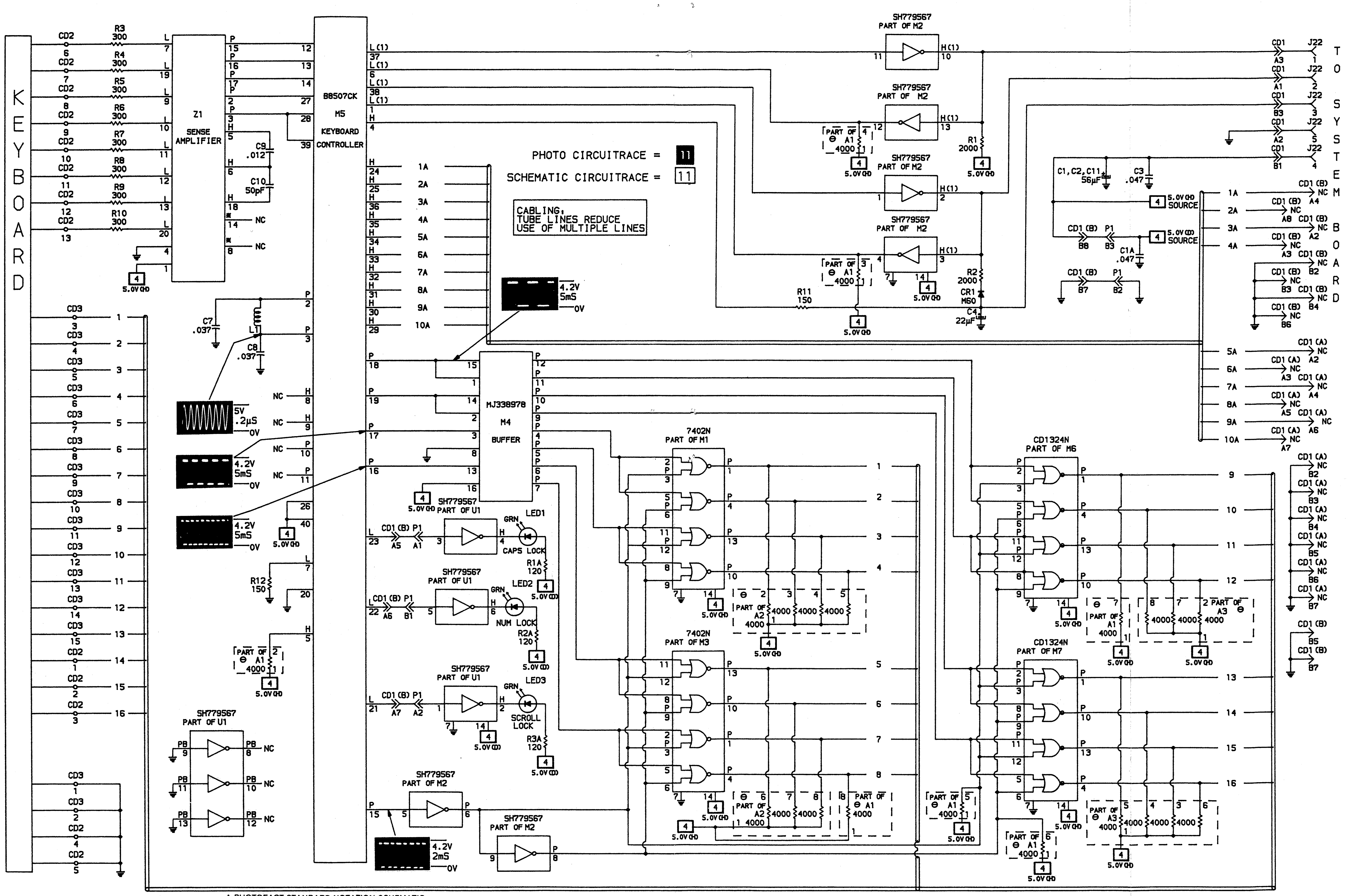
KEYBOARD
Z1 SENSE AMPLIFIER
R3 300
R4 300
R5 300
R6 300
R7 300
R8 300
R9 300
R10 300
C9 .012
C10 50pF
C7 .037
L1
C8 .037
R12 150
88507CK M5 KEYBOARD CONTROLLER
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
CABLING: TUBE LINES REDUCE USE OF MULTIPLE LINES
MJ338978 M4 BUFFER
SH779567 PART OF M2
SH779567 PART OF U1
LED1 GRN CAPS LOCK
LED2 GRN NUM LOCK
LED3 GRN SCROLL LOCK
R1A 120
R2A 120
R3A 120
7402N PART OF M1
7402N PART OF M3
CD1324N PART OF M6
CD1324N PART OF M7
PART OF A1 4000
PART OF A2 4000
PART OF A3 4000
R1 2000
R2 2000
R11 150
CR1 M60
C4 22µF
C1,C2,C11 56µF
C3 .047
C1A .047
5.0V SOURCE
5V .2µS 0V
4.2V 5mS 0V
4.2V 2mS 0V
J22
TO SYSTEM BOARD
CD1 CD2 CD3
NC

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE

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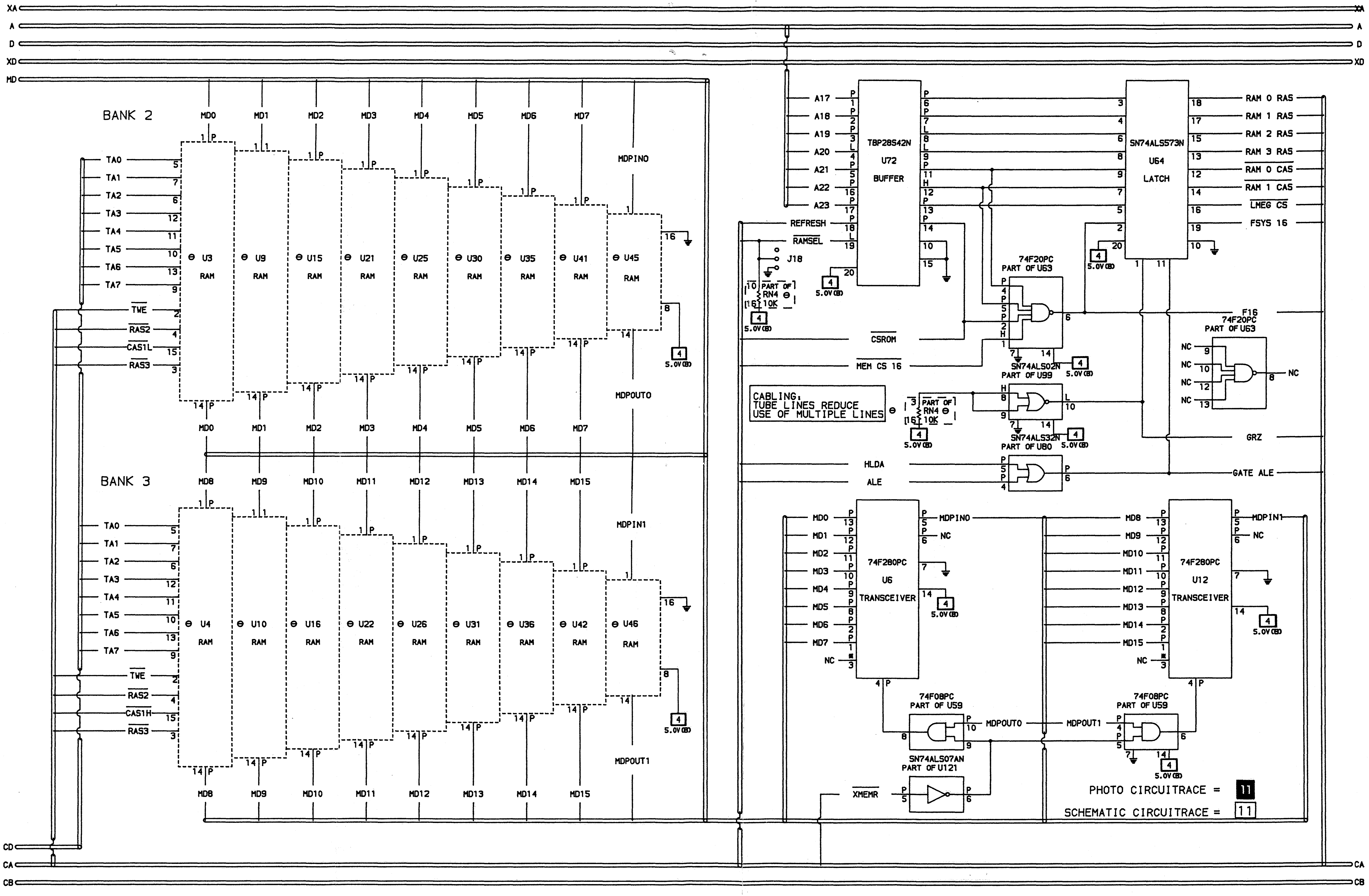
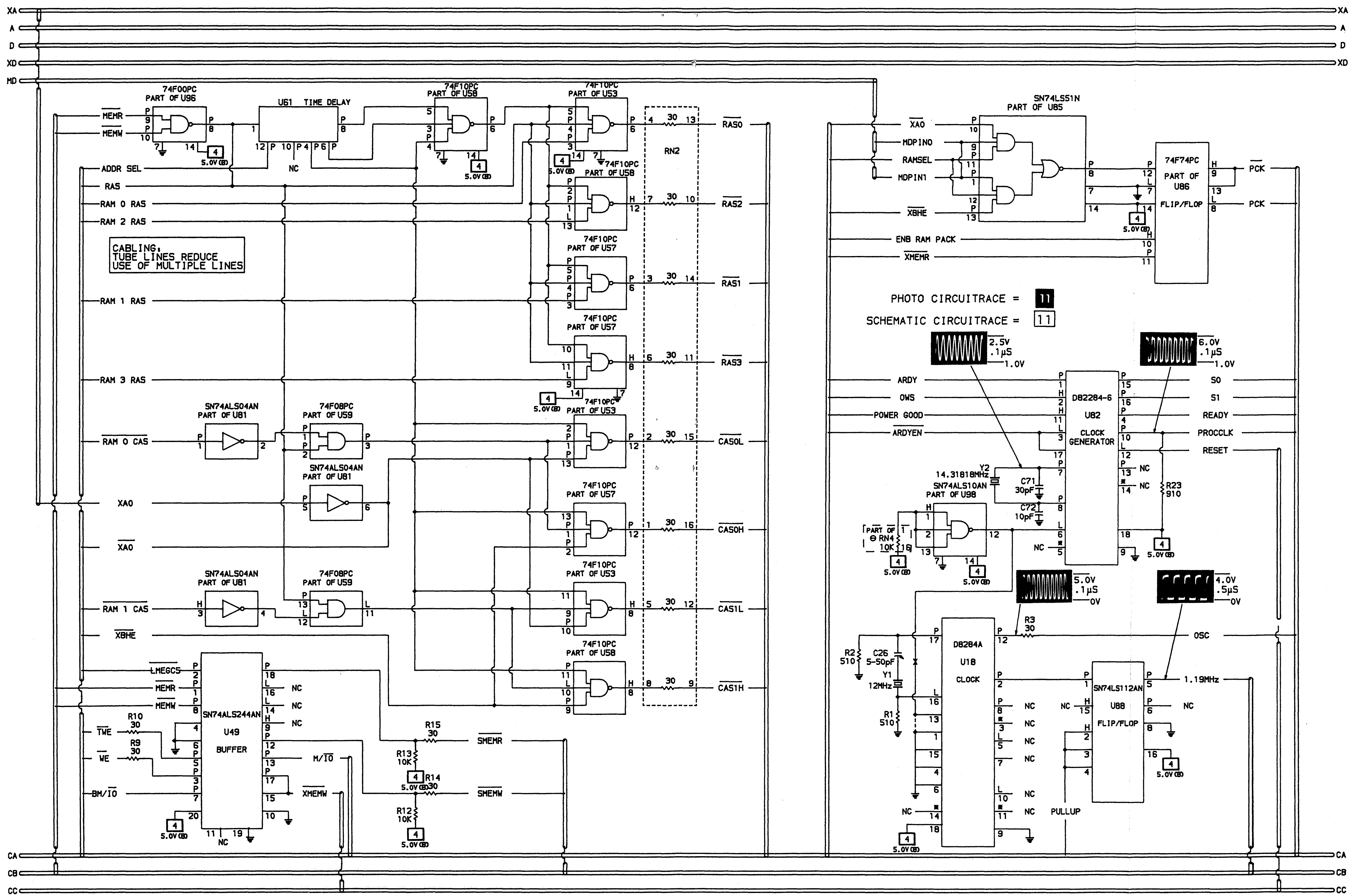

XA
A
D
XD
MD
BANK 2
BANK 3
MD0
MD1
MD2
MD3
MD4
MD5
MD6
MD7
MD8
MD9
MD10
MD11
MD12
MD13
MD14
MD15
MDPIN0
MDPOUT0
MDPIN1
MDPOUT1
TA0
TA1
TA2
TA3
TA4
TA5
TA6
TA7
TWE
RAS2
CAS1L
CAS1H
RAS3
U3 RAM
U9 RAM
U15 RAM
U21 RAM
U25 RAM
U30 RAM
U35 RAM
U41 RAM
U45 RAM
U4 RAM
U10 RAM
U16 RAM
U22 RAM
U26 RAM
U31 RAM
U36 RAM
U42 RAM
U46 RAM
5.0V(B)
A17
A18
A19
A20
A21
A22
A23
REFRESH
RAMSEL
J18
PART OF RN4 10K
TBP28S42N
U72
BUFFER
SN74ALS573N
U64
LATCH
RAM 0 RAS
RAM 1 RAS
RAM 2 RAS
RAM 3 RAS
RAM 0 CAS
RAM 1 CAS
LMEG CS
FSYS 16
74F20PC PART OF U63
F16
CSROM
MEM CS 16
SN74ALS02N PART OF U99
CABLING: TUBE LINES REDUCE USE OF MULTIPLE LINES
SN74ALS32N PART OF U80
GRZ
HLDA
ALE
GATE ALE
NC
74F280PC U6 TRANSCEIVER
74F280PC U12 TRANSCEIVER
74F08PC PART OF U59
SN74ALS07AN PART OF U121
XMEMR
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
CD
CA
CB
CC

IBM PC/AT
MODEL 5170-239

SYSTEM BOARD

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE

SYSTEM BOARD


XA
A
D
XD
MD
CA
CB
CC
74F00PC PART OF U96
MEMR
MEMW
U61 TIME DELAY
NC
74F10PC PART OF U58
74F10PC PART OF U53
74F10PC PART OF U57
74F08PC PART OF U59
SN74ALS04AN PART OF U81
ADDR SEL
RAS
RAM 0 RAS
RAM 2 RAS
RAM 1 RAS
RAM 3 RAS
RAM 0 CAS
XA0
XA0
RAM 1 CAS
XBHE
LMEGCS
TWE
WE
BM/IO
R10 30
R9 30
SN74ALS244AN U49 BUFFER
R15 30
R13 10K
R14 30
R12 10K
SMEMR
SMEMW
M/IO
XMEMW
5.0V
RN2
RAS0
RAS2
RAS1
RAS3
CAS0L
CAS0H
CAS1L
CAS1H
CABLING: TUBE LINES REDUCE USE OF MULTIPLE LINES
SN74LS51N PART OF U85
XA0
MDPIN0
RAMSEL
MDPIN1
XBHE
ENB RAM PACK
XMEMR
74F74PC PART OF U86 FLIP/FLOP
PCK
PCK
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
2.5V .1µS 1.0V
6.0V .1µS 1.0V
ARDY
OWS
POWER GOOD
ARDYEN
D82284-6 U82 CLOCK GENERATOR
S0
S1
READY
PROCCLK
RESET
R23 910
Y2 14.31818MHz
C71 30pF
C72 10pF
SN74ALS10AN PART OF U98
PART OF RN4 10K
5.0V .1µS 0V
4.0V .5µS 0V
R3 30
OSC
D8284A U18 CLOCK
R2 510
C26 5-50pF
Y1 12MHz
R1 510
SN74LS112AN U88 FLIP/FLOP
1.19MHz
PULLUP
NC

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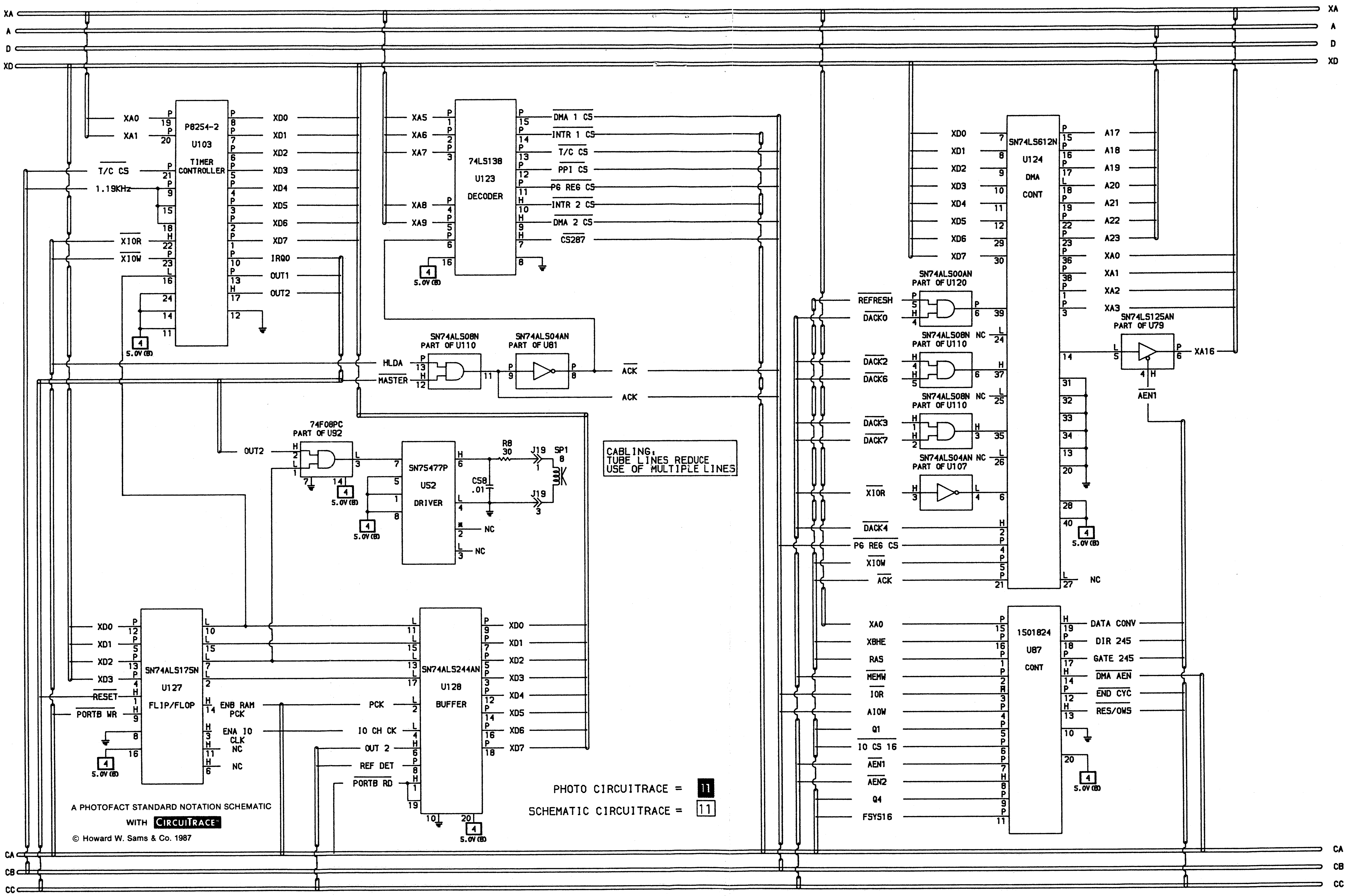
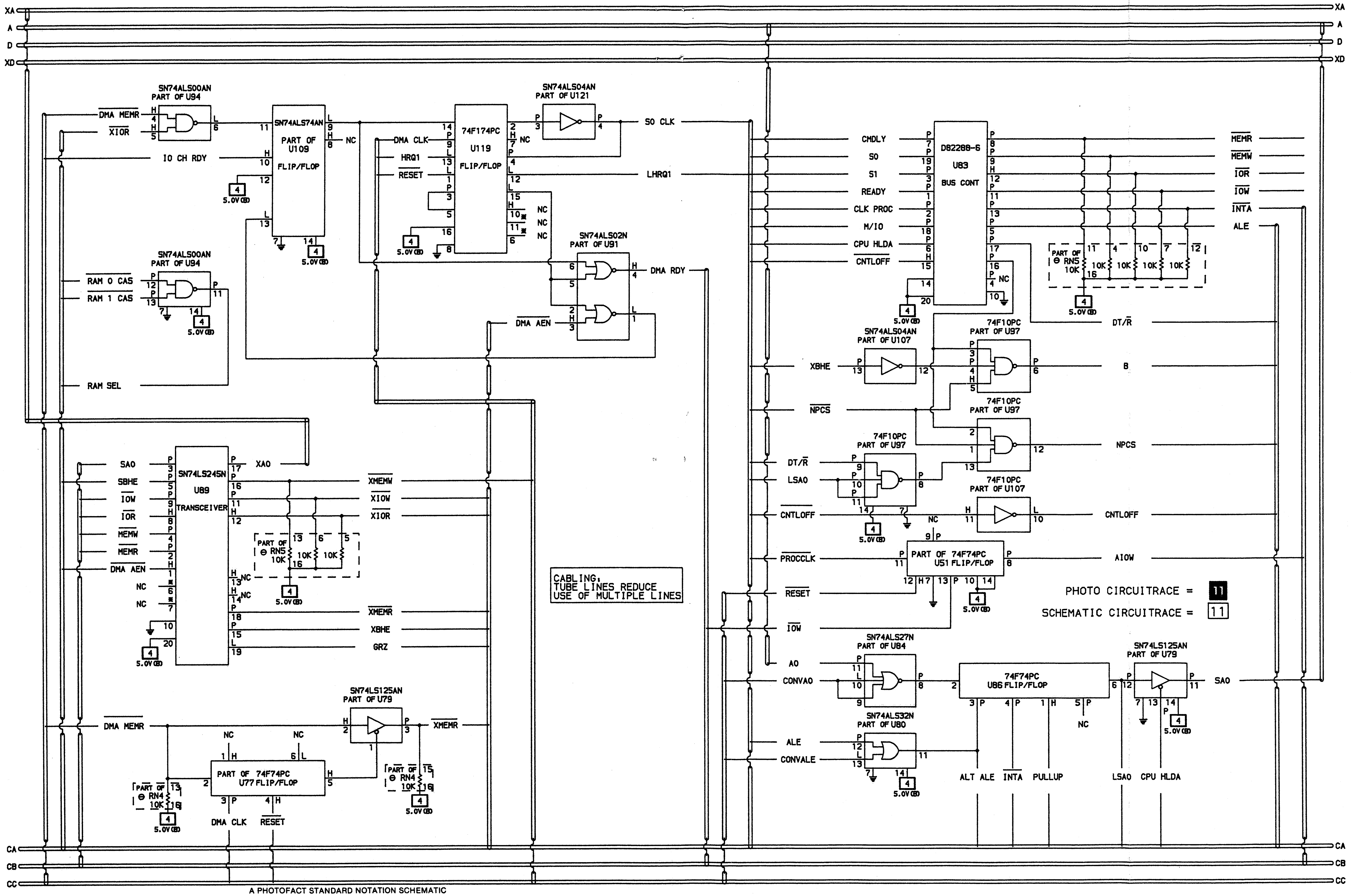
A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE


XA
A
D
XD
XA0
XA1
P8254-2
U103
TIMER CONTROLLER
T/C CS
1.19KHz
XIOR
XIOW
XD0
XD1
XD2
XD3
XD4
XD5
XD6
XD7
IRQ0
OUT1
OUT2
5.0V(B)
XA5
XA6
XA7
XA8
XA9
74LS138
U123
DECODER
DMA 1 CS
INTR 1 CS
T/C CS
PPI CS
P6 REG CS
INTR 2 CS
DMA 2 CS
CS287
HLDA
MASTER
SN74ALS08N
PART OF U110
SN74ALS04AN
PART OF U81
ACK
ACK
74F08PC
PART OF U92
OUT2
SN75477P
U52
DRIVER
R8
30
J19
SP1
8
C58
.01
NC
CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES
SN74LS612N
U124
DMA
CONT
A17
A18
A19
A20
A21
A22
A23
XA0
XA1
XA2
XA3
SN74LS125AN
PART OF U79
XA16
AEN1
SN74ALS00AN
PART OF U120
REFRESH
DACK0
DACK2
DACK6
DACK3
DACK7
SN74ALS04AN
PART OF U107
XIOR
DACK4
P6 REG CS
XIOW
ACK
SN74ALS175N
U127
FLIP/FLOP
RESET
PORTB WR
ENB RAM
PCK
ENA IO
CLK
SN74ALS244AN
U128
BUFFER
PCK
IO CH CK
OUT 2
REF DET
PORTB RD
XA0
XBHE
RAS
MEMW
IOR
AIOW
Q1
IO CS 16
AEN1
AEN2
Q4
FSYS16
1501824
U87
CONT
DATA CONV
DIR 245
GATE 245
DMA AEN
END CYC
RES/OWS
CA
CB
CC

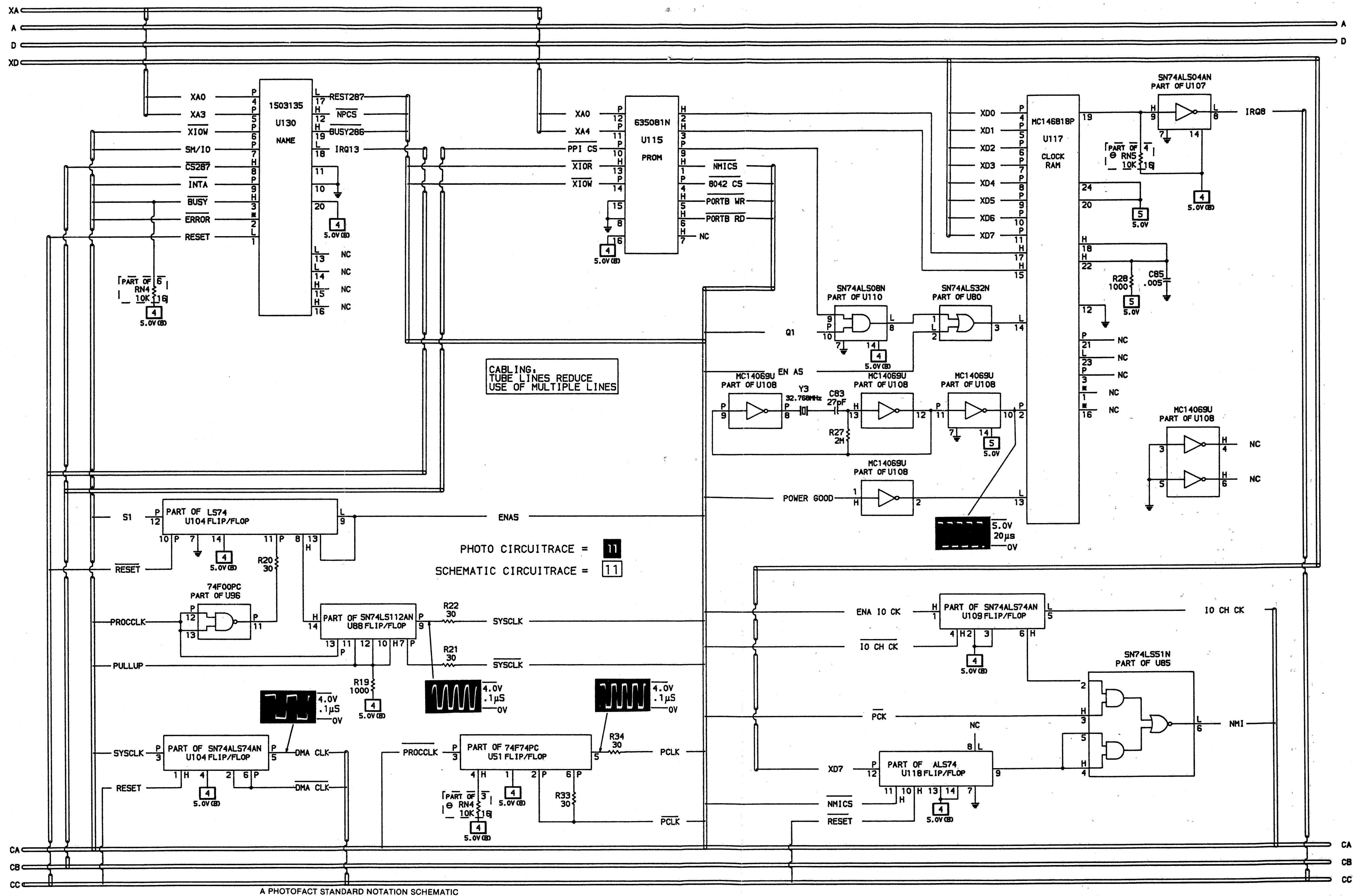
A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE

PHOTO CIRCUITRACE = 11

SCHEMATIC CIRCUITRACE = 11


XA
A
D
XD
SN74ALS00AN PART OF U94
DMA MEMR
XIOR
IO CH RDY
SN74ALS74AN PART OF U109 FLIP/FLOP
NC
5.0V
74F174PC U119 FLIP/FLOP
DMA CLK
HRQ1
RESET
SN74ALS04AN PART OF U121
SO CLK
LHRQ1
SN74ALS02N PART OF U91
DMA RDY
DMA AEN
RAM 0 CAS
RAM 1 CAS
RAM SEL
SAO
SBHE
IOW
IOR
MEMW
MEMR
SN74LS245N U89 TRANSCEIVER
XAO
XMEMW
XIOW
XIOR
PART OF RN5 10K
XMEMR
XBHE
GRZ
CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES
SN74LS125AN PART OF U79
PART OF 74F74PC U77 FLIP/FLOP
PART OF RN4 10K
DMA CLK
RESET
CMDLY
SO
S1
READY
CLK PROC
M/IO
CPU HLDA
CNTLOFF
D82288-6 U83 BUS CONT
MEMR
MEMW
IOR
IOW
INTA
ALE
DT/R
SN74ALS04AN PART OF U107
74F10PC PART OF U97
XBHE
B
NPCS
NPCS
LSAO
74F10PC PART OF U107
CNTLOFF
PROCCLK
PART OF 74F74PC U51 FLIP/FLOP
AIOW
RESET
IOW
SN74ALS27N PART OF U84
A0
CONVAO
74F74PC U86 FLIP/FLOP
SN74LS125AN PART OF U79
SAO
SN74ALS32N PART OF U80
ALE
CONVALE
ALT ALE
INTA
PULLUP
LSAO
CPU HLDA
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
CA
CB
CC

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE®


XA
A
D
XD
XA0
XA3
XIOW
SM/IO
CS287
INTA
BUSY
ERROR
RESET
1503135
U130
NAME
REST287
NPCS
BUSY286
IRQ13
NC
PART OF 6 RN4 10K 16
5.0V
PPI CS
XIOR
635081N
U115
PROM
NMICS
8042 CS
PORTB WR
PORTB RD
XD0
XD1
XD2
XD3
XD4
XD5
XD6
XD7
MC146818P
U117
CLOCK RAM
SN74ALS04AN
PART OF U107
IRQ8
PART OF 4 RN5 10K 16
R28 1000
C85 .005
SN74ALS08N
PART OF U110
SN74ALS32N
PART OF U80
Q1
EN AS
MC14069U
PART OF U108
Y3 32.768MHz
C83 27pF
R27 2M
POWER GOOD
5.0V
20µs
0V
CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES
S1
PART OF LS74
U104 FLIP/FLOP
ENAS
R20 30
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
74F00PC
PART OF U96
PROCCLK
PART OF SN74LS112AN
U88 FLIP/FLOP
R22 30
SYSCLK
R21 30
PULLUP
R19 1000
4.0V
.1µS
0V
SYSCLK
PART OF SN74ALS74AN
U104 FLIP/FLOP
DMA CLK
RESET
PART OF 74F74PC
U51 FLIP/FLOP
PART OF 3 RN4 10K 16
R33 30
R34 30
PCLK
ENA IO CK
PART OF SN74ALS74AN
U109 FLIP/FLOP
IO CH CK
SN74LS51N
PART OF U85
PCK
NC
NMI
XD7
PART OF ALS74
U118 FLIP/FLOP
NMICS
CA
CB
CC

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE

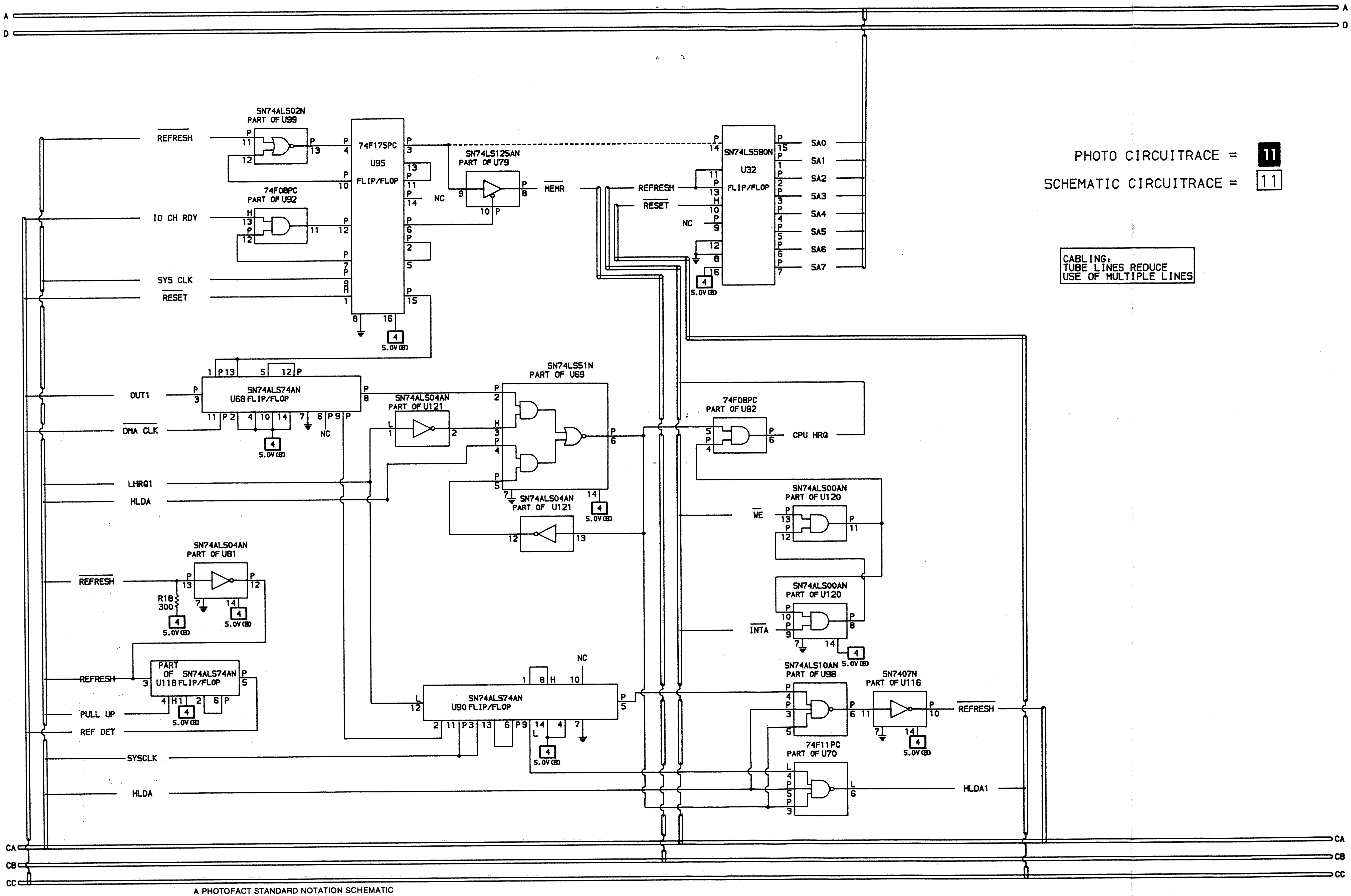

A
D
A
D
SN74ALS02N
PART OF U99
REFRESH
IO CH RDY
74F08PC
PART OF U92
SYS CLK
RESET
74F175PC
U95
FLIP/FLOP
5.0V
SN74LS125AN
PART OF U79
MEMR
NC
REFRESH
RESET
SN74LS590N
U32
FLIP/FLOP
SA0
SA1
SA2
SA3
SA4
SA5
SA6
SA7
OUT1
SN74ALS74AN
U68 FLIP/FLOP
DMA CLK
SN74ALS04AN
PART OF U121
SN74LS51N
PART OF U69
74F08PC
PART OF U92
CPU HRQ
LHRQ1
HLDA
SN74ALS04AN
PART OF U121
SN74ALS00AN
PART OF U120
WE
SN74ALS04AN
PART OF U81
REFRESH
R18
300
SN74ALS00AN
PART OF U120
INTA
PART OF SN74ALS74AN
U118 FLIP/FLOP
REFRESH
PULL UP
REF DET
SYSCLK
HLDA
NC
SN74ALS74AN
U90 FLIP/FLOP
SN74ALS10AN
PART OF U98
SN7407N
PART OF U116
REFRESH
74F11PC
PART OF U70
HLDA1
CA
CB
CC
CA
CB
CC

PHOTO CIRCUITRACE = 11

SCHEMATIC CIRCUITRACE = 11

CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES

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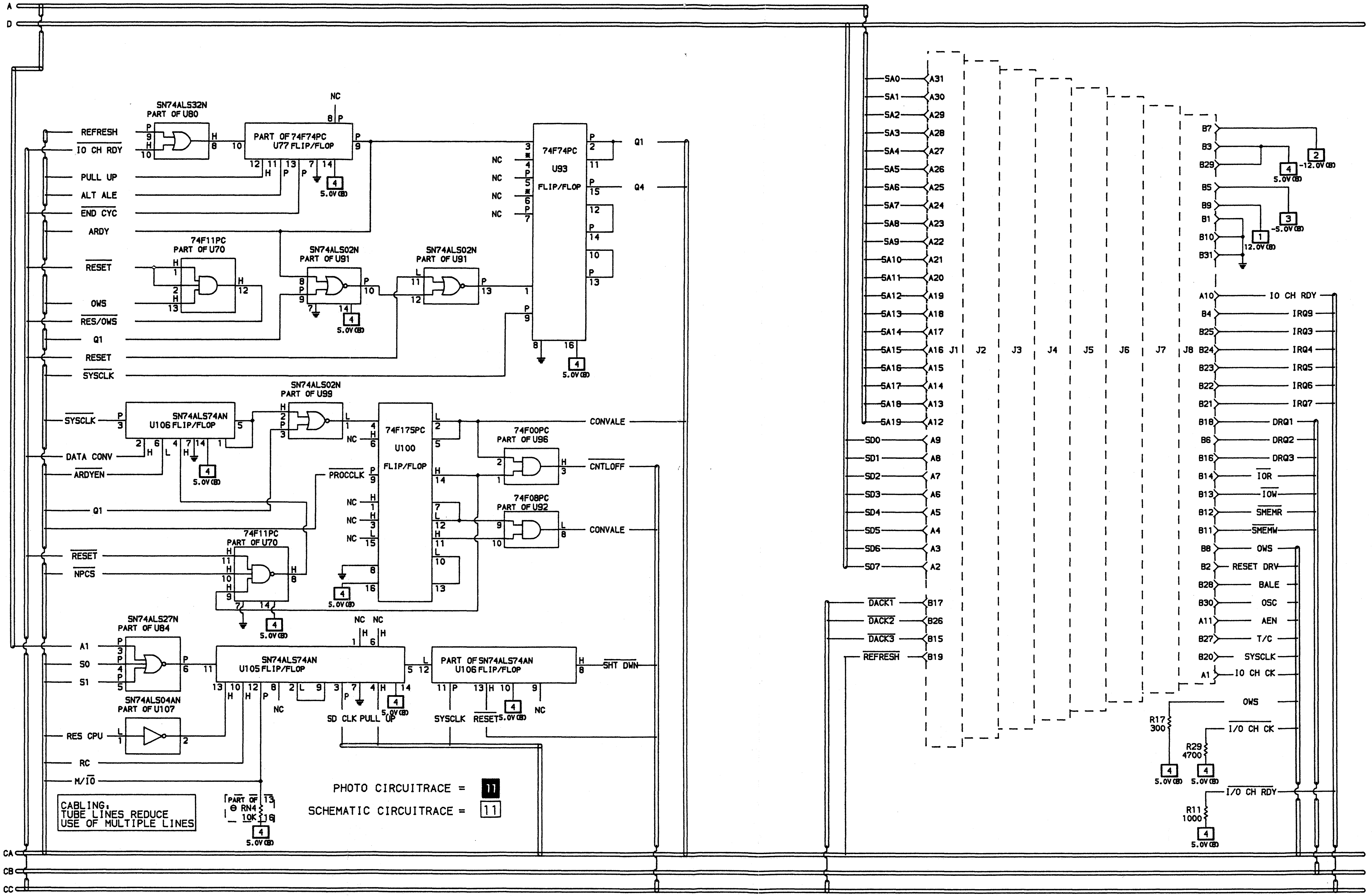
MODEL 5170-239

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE™


A
D
CA
CB
CC
REFRESH
IO CH RDY
PULL UP
ALT ALE
END CYC
ARDY
RESET
OWS
RES/OWS
Q1
RESET
SYSCLK
SN74ALS32N PART OF U80
PART OF 74F74PC U77 FLIP/FLOP
NC
74F74PC U93 FLIP/FLOP
Q1
Q4
74F11PC PART OF U70
SN74ALS02N PART OF U91
SN74ALS02N PART OF U91
5.0V(B)
SYSCLK
DATA CONV
ARDYEN
SN74ALS74AN U106 FLIP/FLOP
SN74ALS02N PART OF U99
74F175PC U100 FLIP/FLOP
PROCCLK
CONVALE
74F00PC PART OF U96
CNTLOFF
74F08PC PART OF U92
CONVALE
Q1
RESET
NPCS
74F11PC PART OF U70
SN74ALS27N PART OF U84
A1
S0
S1
SN74ALS74AN U105 FLIP/FLOP
PART OF SN74ALS74AN U106 FLIP/FLOP
SHT DWN
SN74ALS04AN PART OF U107
RES CPU
RC
M/IO
SD CLK PULL UP
SYSCLK
RESET
PART OF RN4 10K
CABLING: TUBE LINES REDUCE USE OF MULTIPLE LINES
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
SA0
SA1
SA2
SA3
SA4
SA5
SA6
SA7
SA8
SA9
SA10
SA11
SA12
SA13
SA14
SA15
SA16
SA17
SA18
SA19
SD0
SD1
SD2
SD3
SD4
SD5
SD6
SD7
DACK1
DACK2
DACK3
REFRESH
A31
A30
A29
A28
A27
A26
A25
A24
A23
A22
A21
A20
A19
A18
A17
A16
A15
A14
A13
A12
A9
A8
A7
A6
A5
A4
A3
A2
B17
B26
B15
B19
J1
J2
J3
J4
J5
J6
J7
J8
B7
B3
B29
-12.0V(B)
5.0V(B)
B5
B9
B1
B10
B31
-5.0V(B)
12.0V(B)
A10
IO CH RDY
B4
IRQ9
B25
IRQ3
B24
IRQ4
B23
IRQ5
B22
IRQ6
B21
IRQ7
B18
DRQ1
B6
DRQ2
B16
DRQ3
B14
IOR
B13
IOW
B12
SMEMR
B11
SMEMW
B8
OWS
B2
RESET DRV
B28
BALE
B30
OSC
A11
AEN
B27
T/C
B20
SYSCLK
A1
IO CH CK
OWS
R17 300
I/O CH CK
R29 4700
I/O CH RDY
R11 1000

IBM PC/AT
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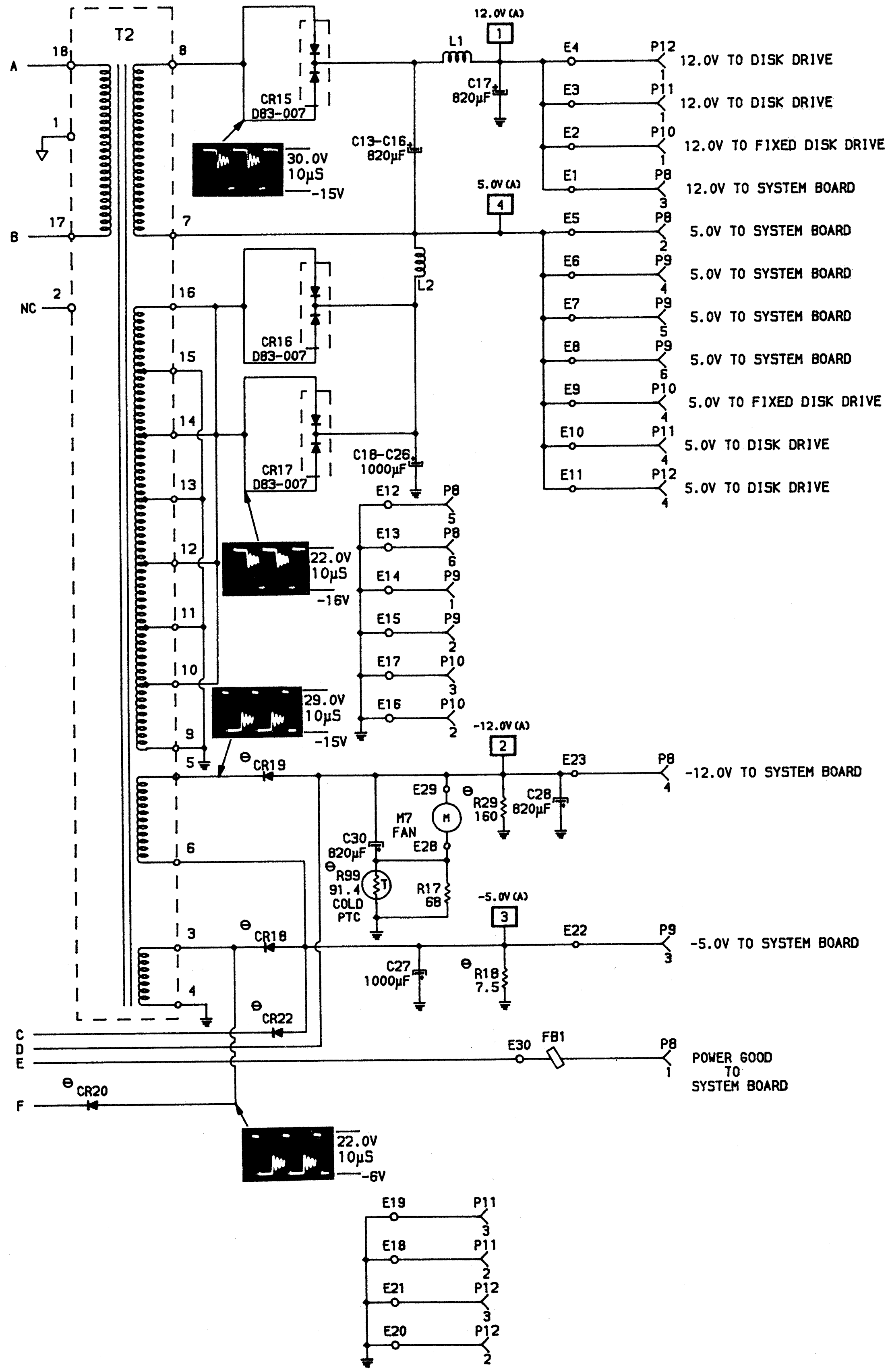
A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE


T2
A
B
NC
C
D
E
F
18
17
1
2
8
7
16
15
14
13
12
11
10
9
6
5
3
4
CR15
D83-007
30.0V
10µS
-15V
CR16
D83-007
CR17
D83-007
22.0V
10µS
-16V
29.0V
10µS
-15V
L1
L2
12.0V (A)
1
C17
820µF
C13-C16
820µF
5.0V (A)
4
C18-C26
1000µF
E4 P12 12.0V TO DISK DRIVE
E3 P11 12.0V TO DISK DRIVE
E2 P10 12.0V TO FIXED DISK DRIVE
E1 P8 12.0V TO SYSTEM BOARD
E5 P8 5.0V TO SYSTEM BOARD
E6 P9 5.0V TO SYSTEM BOARD
E7 P9 5.0V TO SYSTEM BOARD
E8 P9 5.0V TO SYSTEM BOARD
E9 P10 5.0V TO FIXED DISK DRIVE
E10 P11 5.0V TO DISK DRIVE
E11 P12 5.0V TO DISK DRIVE
E12 P8
E13 P8
E14 P9
E15 P9
E17 P10
E16 P10
CR19
-12.0V (A)
2
E23
P8
-12.0V TO SYSTEM BOARD
E29
M7
FAN
M
E28
R29
160
C28
820µF
C30
820µF
R99
91.4
COLD
PTC
R17
68
-5.0V (A)
3
CR18
E22
P9
-5.0V TO SYSTEM BOARD
C27
1000µF
R18
7.5
CR22
E30
FB1
P8
POWER GOOD TO SYSTEM BOARD
CR20
22.0V
10µS
-6V
E19 P11
E18 P11
E21 P12
E20 P12

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE
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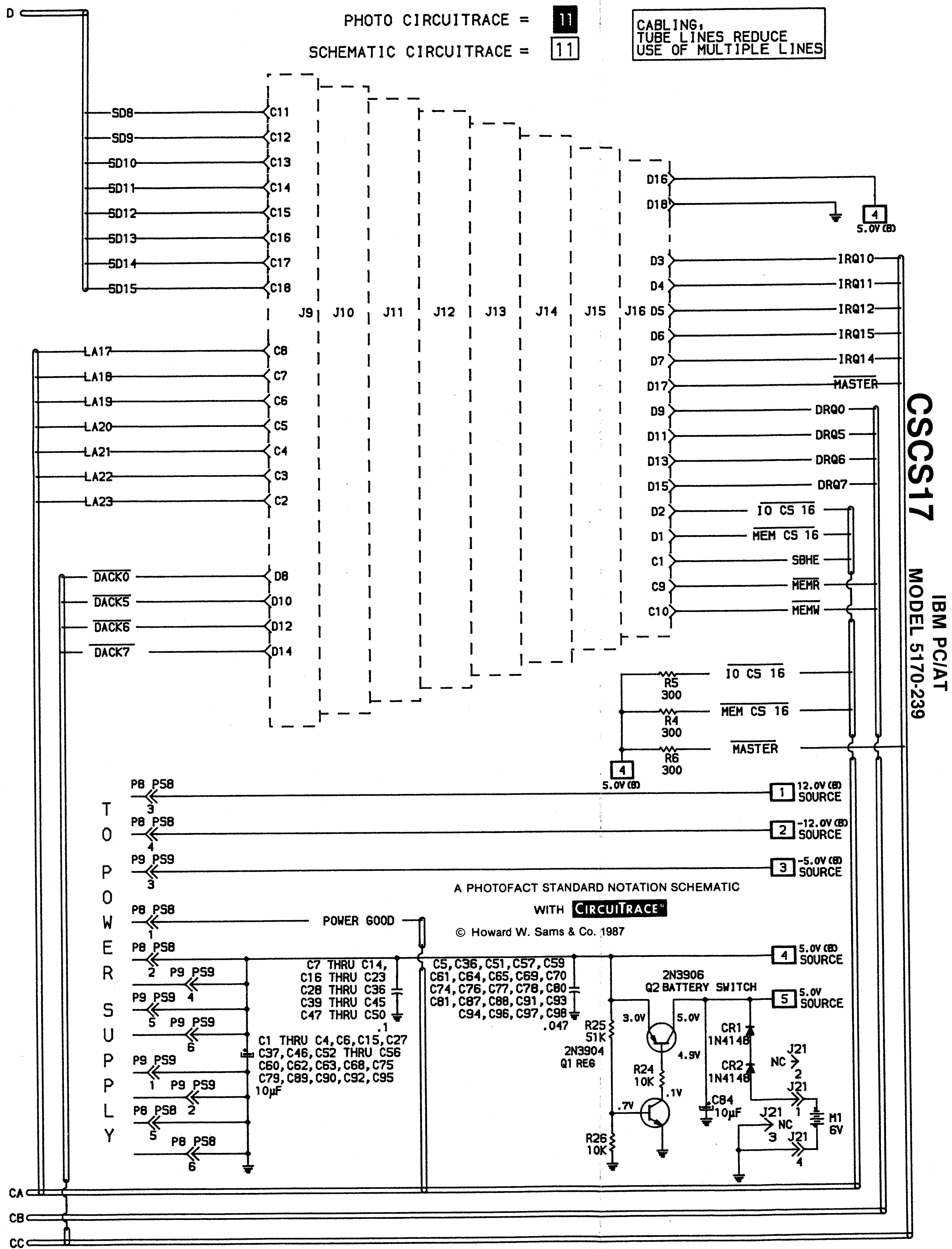
POWER SUPPLY

PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11

CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES


D
SD8
SD9
SD10
SD11
SD12
SD13
SD14
SD15
C11
C12
C13
C14
C15
C16
C17
C18
LA17
LA18
LA19
LA20
LA21
LA22
LA23
C8
C7
C6
C5
C4
C3
C2
DACK0
DACK5
DACK6
DACK7
D8
D10
D12
D14
J9
J10
J11
J12
J13
J14
J15
J16
D16
D18
4
5.0V (B)
D3 IRQ10
D4 IRQ11
D5 IRQ12
D6 IRQ15
D7 IRQ14
D17 MASTER
D9 DRQ0
D11 DRQ5
D13 DRQ6
D15 DRQ7
D2 IO CS 16
D1 MEM CS 16
C1 SBHE
C9 MEMR
C10 MEMW
R5
300
IO CS 16
R4
300
MEM CS 16
R6
300
MASTER
T O P O W E R S U P P L Y
P8 PS8
1 12.0V (B) SOURCE
2 -12.0V (B) SOURCE
P9 PS9
3 -5.0V (B) SOURCE
POWER GOOD
4 5.0V (B) SOURCE
5 5.0V SOURCE
C7 THRU C14, C16 THRU C23 C28 THRU C36 C39 THRU C45 C47 THRU C50 .1
C5, C36, C51, C57, C59 C61, C64, C65, C69, C70 C74, C76, C77, C78, C80 C81, C87, C88, C91, C93 C94, C96, C97, C98 .047
C1 THRU C4, C6, C15, C27 C37, C46, C52 THRU C56 C60, C62, C63, C68, C75 C79, C89, C90, C92, C95 10µF
2N3906
Q2 BATTERY SWITCH
3.0V
5.0V
4.9V
.1V
.7V
R25
51K
2N3904
Q1 RE6
R24
10K
R26
10K
CR1
1N4148
CR2
1N4148
C84
10µF
J21
NC
M1
6V
CA
CB
CC

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE
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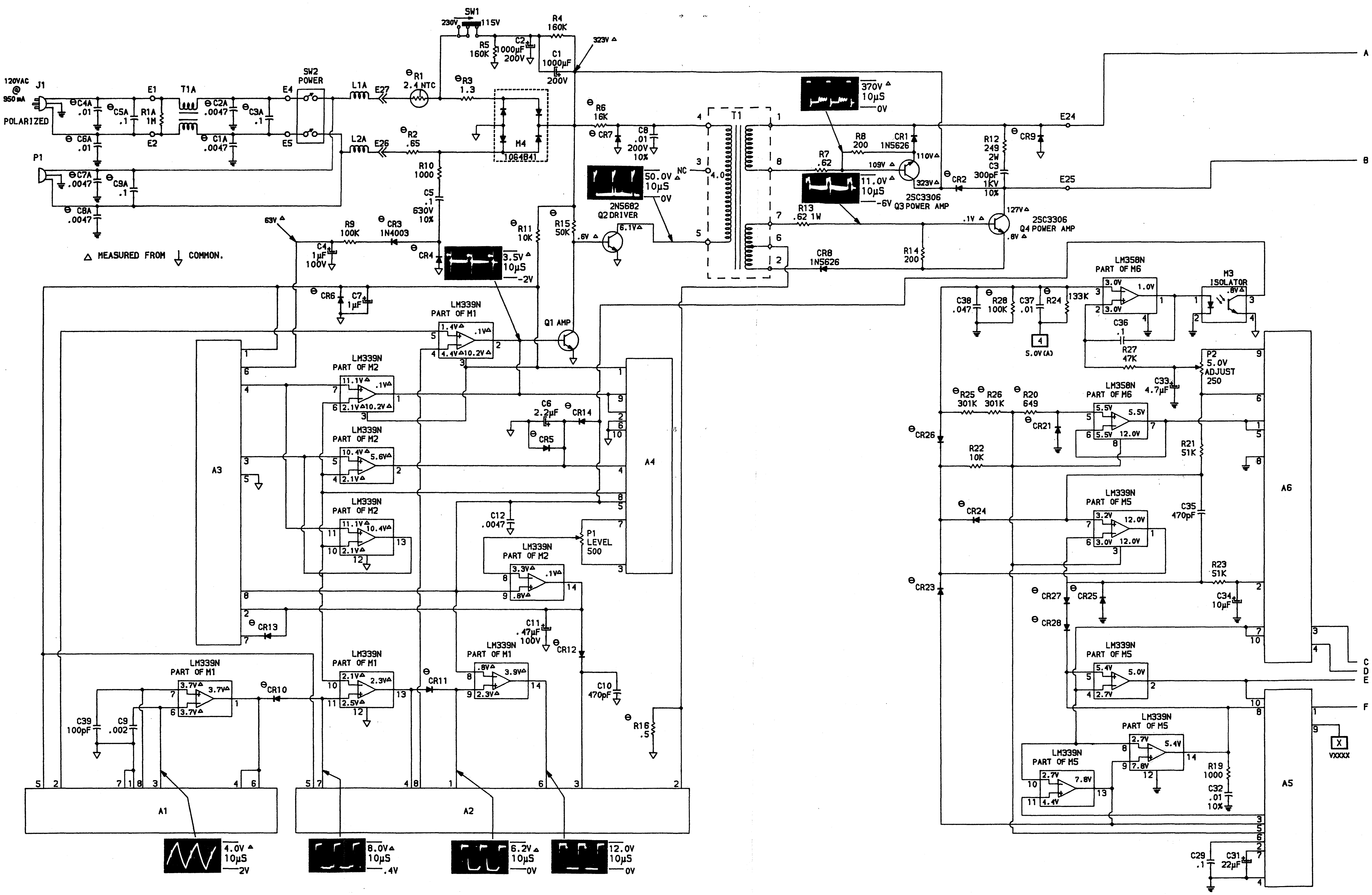
CSCS17

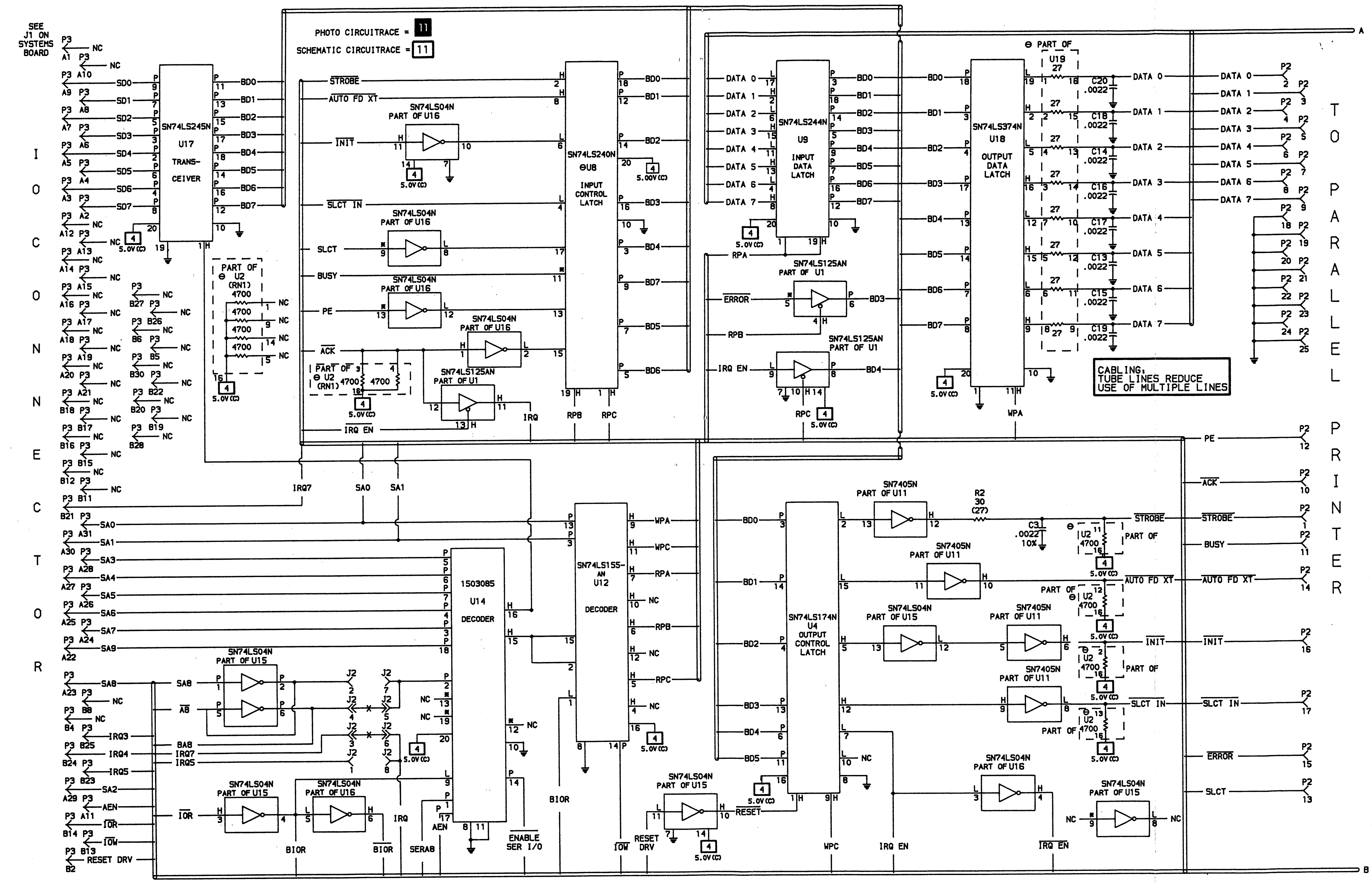
IBM PC/AT
MODEL 5170-239

SYSTEM BOARD

IBM PC/AT
MODEL 5170-239


120VAC @ 950mA
J1
POLARIZED
P1
C4A .01
C5A .1
R1A 1M
E1
E2
T1A
C2A .0047
C1A .0047
C3A .1
C6A .01
C7A .0047
C9A .1
C8A .0047
E4
E5
SW2 POWER
L1A
L2A
E27
E26
R1 2.4 NTC
R2 .65
R3 1.3
SW1 230V 115V
R5 160K
C2 1000µF 200V
R4 160K
C1 1000µF 200V
323V
M4 1064841
R10 1000
C5 .1 630V 10%
R6 16K
CR7
C8 .01 200V 10%
T1
NC
4.0
370V 10µS 0V
50.0V 10µS 0V
11.0V 10µS -6V
R8 200
CR1 1N5626
R7 .62
R13 .62 1W
110V
109V
323V
2SC3306 Q3 POWER AMP
2SC3306 Q4 POWER AMP
127V
.1V
.8V
CR2
R12 249 2W
C3 300pF 1KV 10%
CR9
E24
E25
R14 200
CR8 1N5626
2N5682 Q2 DRIVER
6.1V
.6V
R15 50K
R11 10K
63V
R9 100K
CR3 1N4003
C4 1µF 100V
CR4
3.5V 10µS -2V
△ MEASURED FROM COMMON.
CR6
C7 1µF
LM339N PART OF M1
Q1 AMP
LM339N PART OF M2
C6 2.2µF
CR14
CR5
A3
A4
C12 .0047
P1 LEVEL 500
CR13
C11 .47µF 100V
CR12
C10 470pF
CR10
CR11
C39 100pF
C9 .002
R16 .5
A1
A2
4.0V 10µS 2V
8.0V 10µS .4V
6.2V 10µS 0V
12.0V 10µS 0V
LM358N PART OF M6
M3 ISOLATOR
C38 .047
R28 100K
C37 .01
R24 133K
5.0V(A)
C36 .1
R27 47K
P2 5.0V ADJUST 250
C33 4.7µF
R25 301K
R26 301K
R20 649
CR21
CR26
R22 10K
R21 51K
LM339N PART OF M5
CR24
C35 470pF
A6
CR23
R23 51K
CR27
CR25
CR28
C34 10µF
R19 1000
C32 .01 10%
A5
VXXXX
C29 .1
C31 22µF
A
B
C
D
E
F

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE

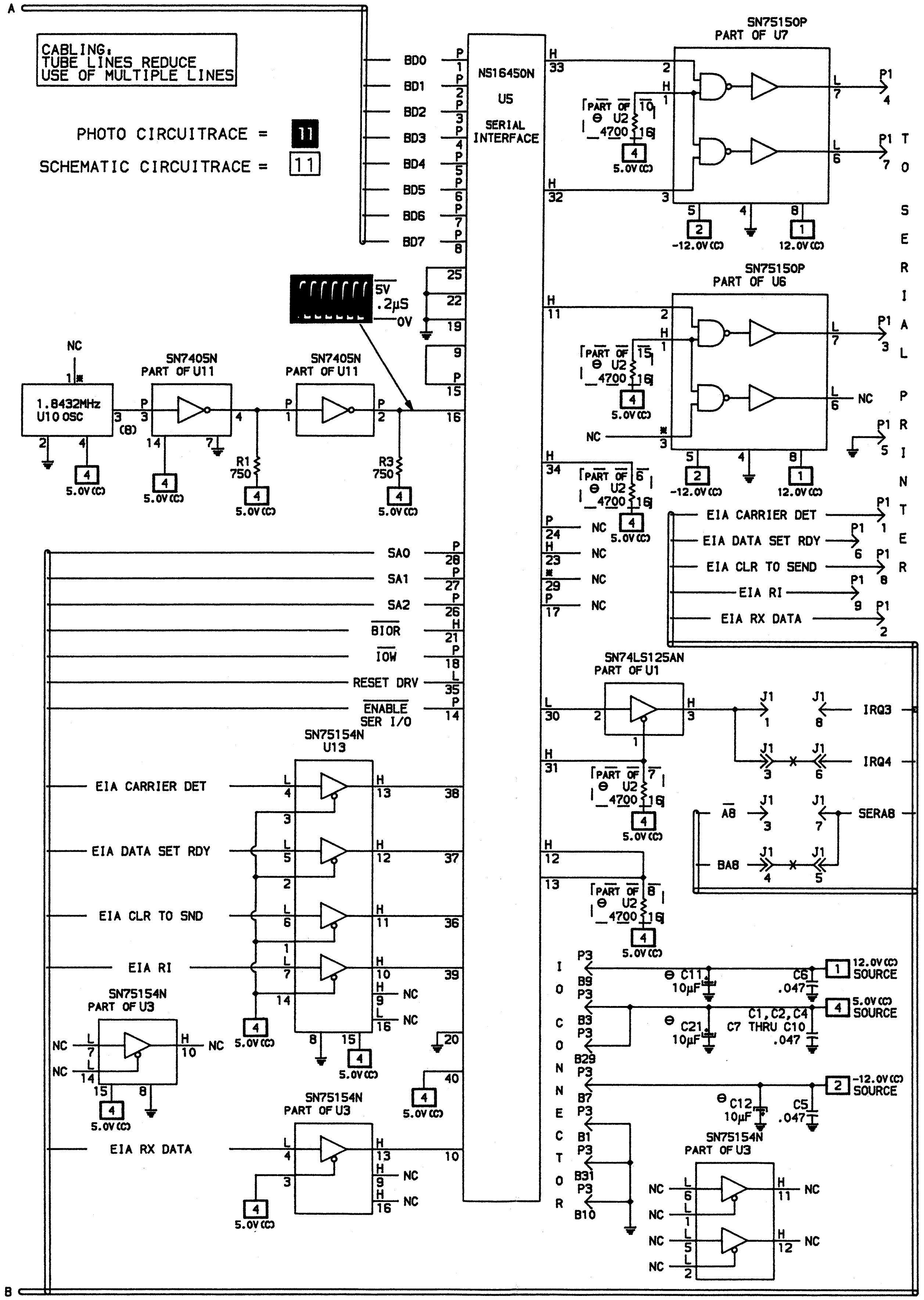

SEE J1 ON SYSTEMS BOARD
I O CONNECTOR
TO PARALLEL PRINTER
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
SN74LS245N U17 TRANS-CEIVER
SN74LS240N ⊖U8 INPUT CONTROL LATCH
SN74LS244N U9 INPUT DATA LATCH
SN74LS374N U18 OUTPUT DATA LATCH
SN74LS04N PART OF U16
SN74LS04N PART OF U15
SN74LS125AN PART OF U1
SN7405N PART OF U11
SN74LS155-AN U12 DECODER
1503085 U14 DECODER
SN74LS174N U4 OUTPUT CONTROL LATCH
PART OF ⊖ U2 (RN1) 4700
⊖ PART OF U19 27
CABLING; TUBE LINES REDUCE USE OF MULTIPLE LINES
STROBE
AUTO FD XT
INIT
SLCT IN
SLCT
BUSY
PE
ACK
ERROR
IRQ EN
IRQ7
SA0
SA1
BIOR
IOR
IOW
RESET DRV
ENABLE SER I/O
SERA8
AEN
WPA
WPC
RPA
RPB
RPC
DATA 0
DATA 1
DATA 2
DATA 3
DATA 4
DATA 5
DATA 6
DATA 7
BD0
BD1
BD2
BD3
BD4
BD5
BD6
BD7
R2 30 (27)
C3 .0022 10%
5.0V(C)
P2
P3
J2
A
B

CSCS17

IBM PC/AT MODEL 5170-239

A PHOTOFACT STANDARD NOTATION SCHEMATIC

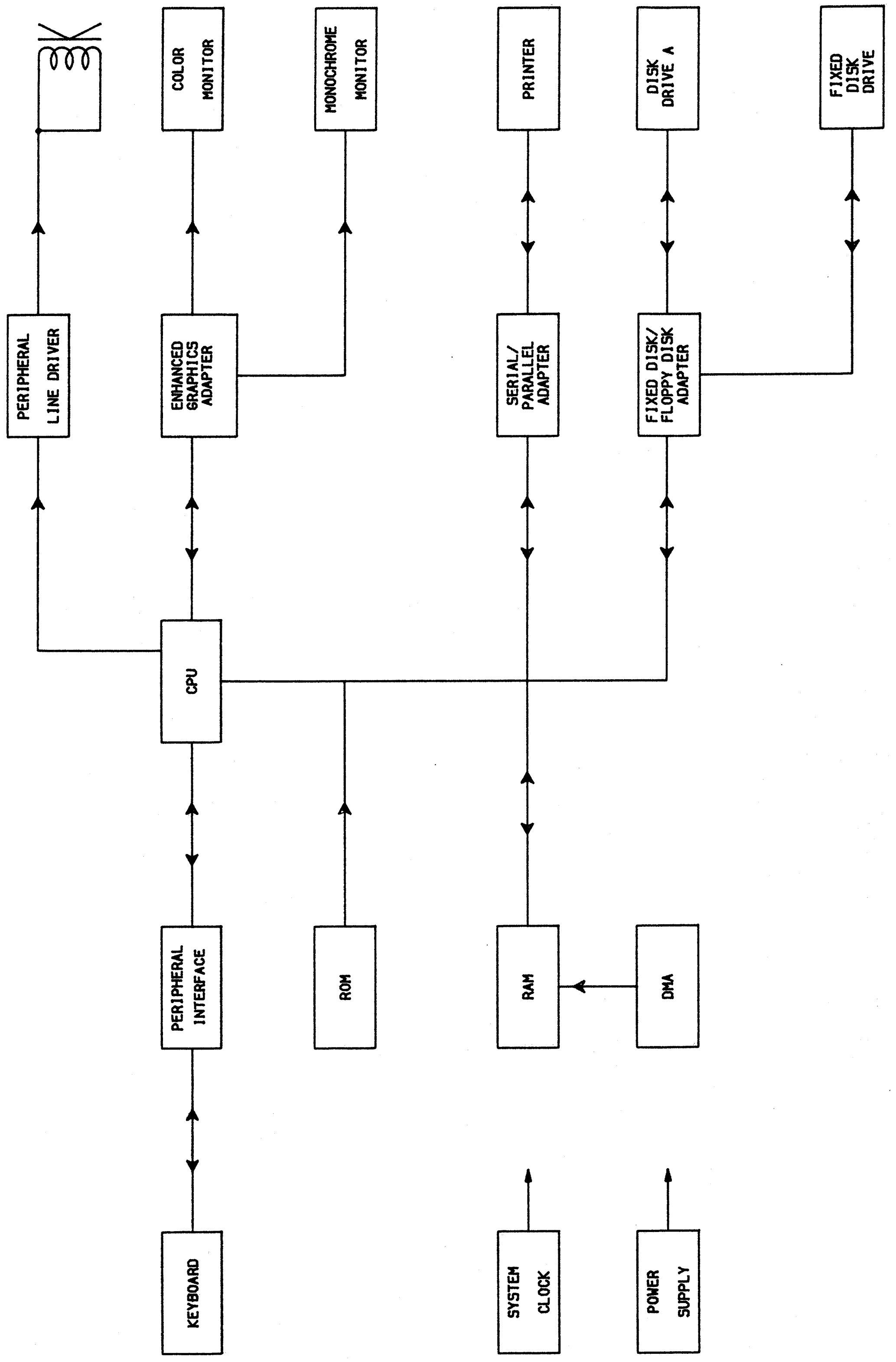
WITH CIRCUITRACE


CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
A
B
BD0
BD1
BD2
BD3
BD4
BD5
BD6
BD7
NS16450N
U5
SERIAL INTERFACE
SN75150P
PART OF U7
SN75150P
PART OF U6
PART OF U2
4700
5.0V(C)
-12.0V(C)
12.0V(C)
5V
.2μS
0V
NC
1.8432MHz
U10 OSC
SN7405N
PART OF U11
R1
750
R3
750
SA0
SA1
SA2
BIOR
IOW
RESET DRV
ENABLE SER I/O
SN75154N
U13
EIA CARRIER DET
EIA DATA SET RDY
EIA CLR TO SND
EIA RI
SN75154N
PART OF U3
EIA RX DATA
EIA CARRIER DET
EIA DATA SET RDY
EIA CLR TO SEND
EIA RI
EIA RX DATA
P1
TO SERIAL PRINTER
SN74LS125AN
PART OF U1
J1
IRQ3
IRQ4
A8
BA8
SERA8
I/O CONNECTOR
P3
C11
10μF
C6
.047
C21
10μF
C1, C2, C4
C7 THRU C10
.047
C12
10μF
C5
.047
12.0V(C) SOURCE
5.0V(C) SOURCE
-12.0V(C) SOURCE
SN75154N
PART OF U3

A PHOTOFACT STANDARD NOTATION SCHEMATIC

WITH CIRCUITRACE®

SERIAL/PARALLEL ADAPTER


COLOR MONITOR
MONOCHROME MONITOR
PRINTER
DISK DRIVE A
FIXED DISK DRIVE
PERIPHERAL LINE DRIVER
ENHANCED GRAPHICS ADAPTER
SERIAL/PARALLEL ADAPTER
FIXED DISK/FLOPPY DISK ADAPTER
CPU
PERIPHERAL INTERFACE
ROM
RAM
DMA
KEYBOARD
SYSTEM CLOCK
POWER SUPPLY

IBM PC/AT
MODEL 5170-239

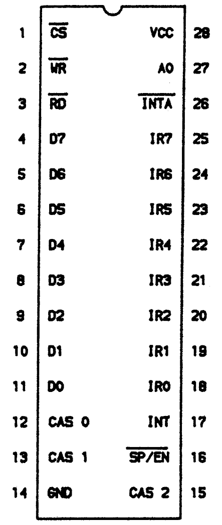
BLOCK DIAGRAM

CSCS17

IBM PC/AT MODEL 5170-239

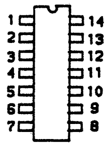
IC PINOUTS & TERMINAL GUIDES

P8259A



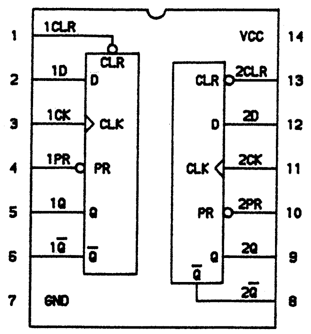
CS
VCC
WR
A0
RD
INTA
D7
IR7
D6
IR6
D5
IR5
D4
IR4
D3
IR3
D2
IR2
D1
IR1
D0
IR0
CAS 0
INT
CAS 1
SP/EN
GND
CAS 2

U114,U125
INTERRUPT
CONTROLLER
TOP VIEW



U53,U57,U58,U59,
U62,U63,U69,U70,
U78 THRU U81,U84,U85,U91,
U92,U94,U96 THRU U99,U107,
U108,U110,U116,U120,U121
TOP VIEW

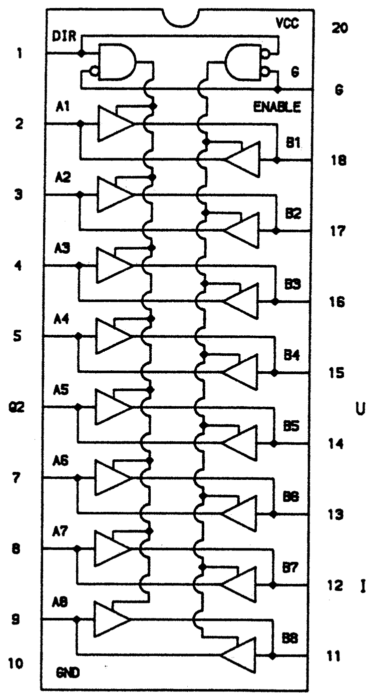
74F74PC,SN74ALS74AN



1CLR
VCC
1D
CLR
2CLR
1CK
CLK
2D
1PR
PR
2CK
1Q
2PR
GND
2Q

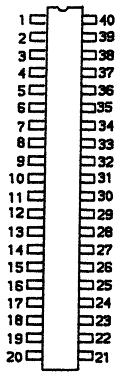
U51,U68,U77,U86,U90,
U104,U105,U106,U109,U118
FLIP/FLOP
TOP VIEW

SN74ALS245AN,SN74LS245N



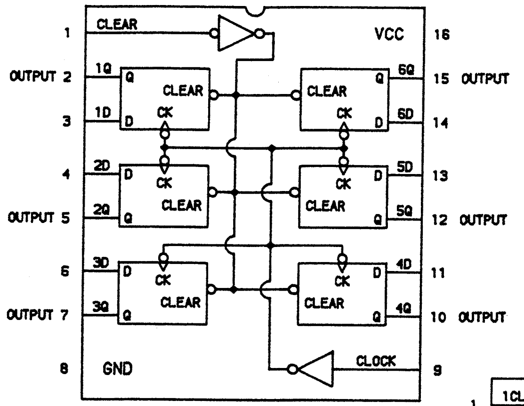
DIR
VCC
G
ENABLE
A1
B1
A2
B2
A3
B3
A4
B4
A5
B5
A6
B6
A7
B7
A8
B8
GND

U5,U11,U38,U48,U65,U66,
U89,U102,U113
TRANSCEIVER
TOP VIEW



U111,U122,U124,U126
TOP VIEW

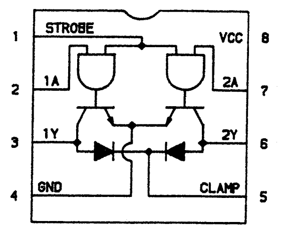
74F174PC



CLEAR
VCC
OUTPUT
CK
CLOCK
GND

U90,U93,U119
FLIP/FLOP
TOP VIEW

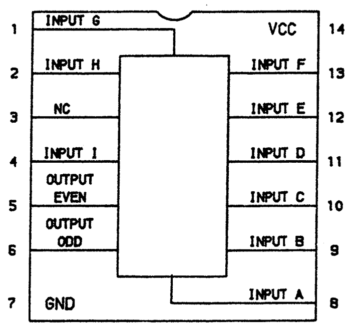
SN75477P



STROBE
VCC
1A
2A
1Y
2Y
GND
CLAMP

U52
LINE DRIVER

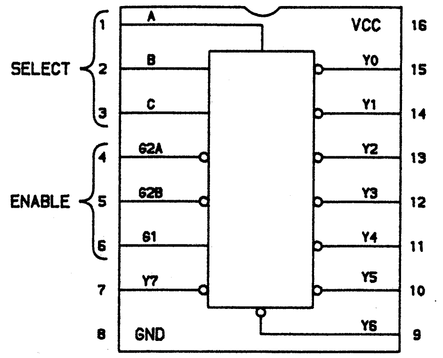
74F280PC



INPUT G
VCC
INPUT H
INPUT F
NC
INPUT E
INPUT I
INPUT D
OUTPUT EVEN
INPUT C
OUTPUT ODD
INPUT B
GND
INPUT A

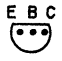
U6,U12
PARITY GENERATOR CHECKER
TOP VIEW

SN74ALS138N



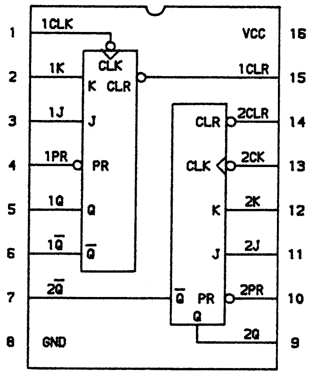
SELECT
ENABLE
A
B
C
G2A
G2B
G1
Y7
GND
VCC
Y0
Y1
Y2
Y3
Y4
Y5
Y6

U123
DECODER
TOP VIEW



Q1,Q2
BOTTOM VIEW

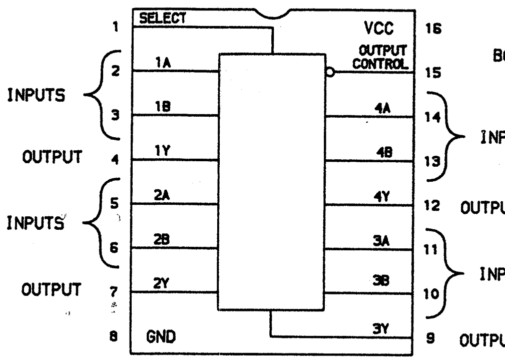
SN74LS112AN



1CLK
VCC
1K
1CLR
1J
2CLR
1PR
2CK
1Q
2K
2J
2Q
2PR
GND

U88
FLIP/FLOP
TOP VIEW

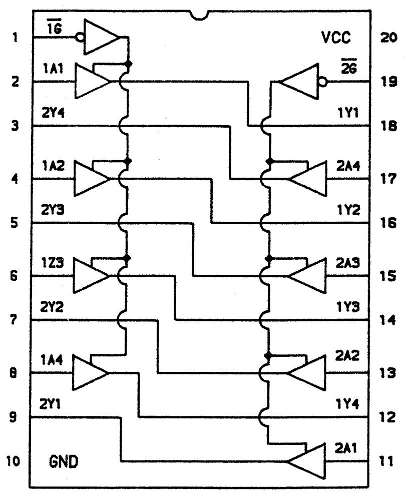
74F257PC



SELECT
VCC
OUTPUT CONTROL
INPUTS
OUTPUT
1A
1B
1Y
2A
2B
2Y
GND
4A
4B
4Y
3A
3B
3Y

U129
MULTIPLEXER
TOP VIEW

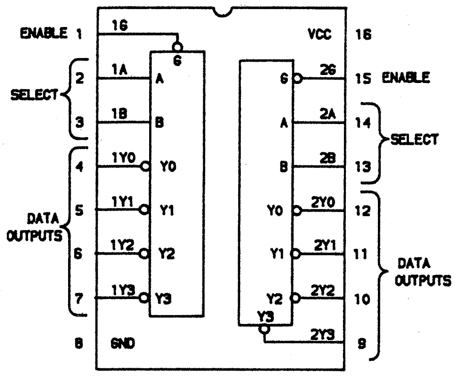
SN74ALS244AN



1G
VCC
1A1
2G
2Y4
1Y1
1A2
2A4
2Y3
1Y2
1A3
2A3
2Y2
1Y3
1A4
2A2
2Y1
1Y4
GND
2A1

U49,U75,U128
BUFFER
TOP VIEW

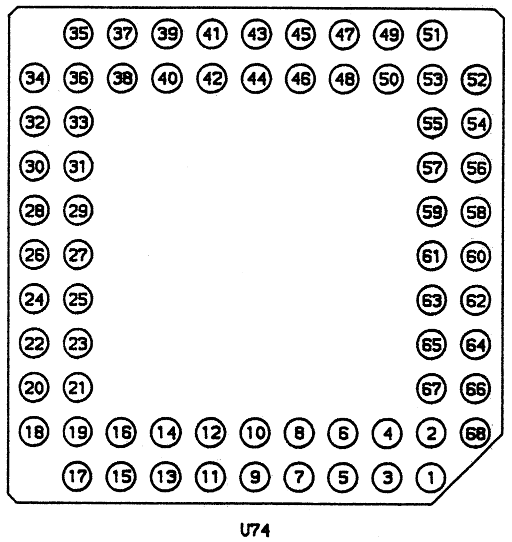
74F139PC



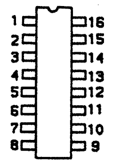
ENABLE
SELECT
DATA OUTPUTS
1G
VCC
1A
2G
1B
2A
1Y0
2B
1Y1
2Y0
1Y2
2Y1
1Y3
2Y2
GND
2Y3

U71
DECODER
TOP VIEW

CG80286-6C

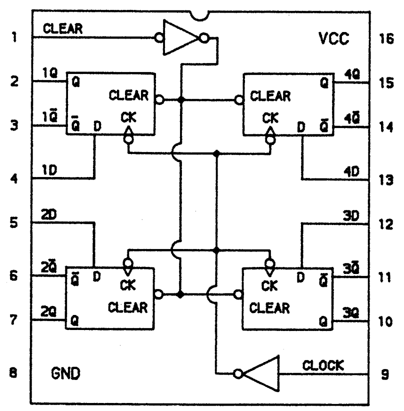


U74
BOTTOM VIEW



U1 THRU U4,U7 THRU U10,
U13 THRU U16,U19 THRU U26,
U28 THRU U36,U39 THRU U46,
U115
TOP VIEW

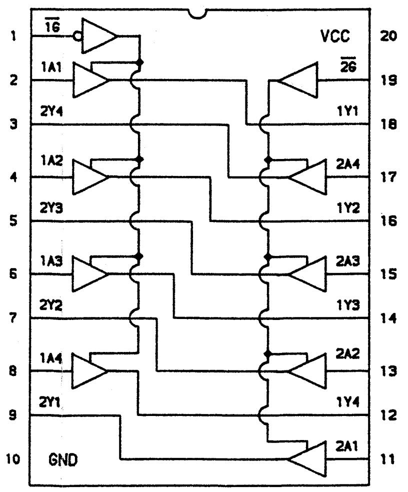
74F175PC,SN74ALS175N



CLEAR
VCC
1Q
4Q
1D
4D
2D
3D
2Q
3Q
CLOCK
GND

U95,U100,U127
FLIP/FLOP
TOP VIEW

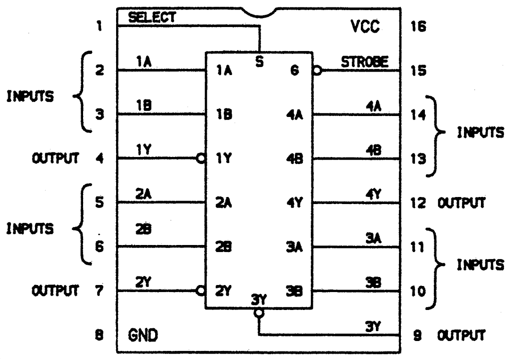
74F241PC



1G
VCC
1A1
2G
2Y4
1Y1
1A2
2A4
2Y3
1Y2
1A3
2A3
2Y2
1Y3
1A4
2A2
2Y1
1Y4
GND
2A1

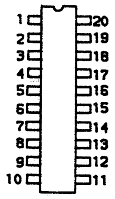
U50
TRANSCEIVER
TOP VIEW

74F158PC

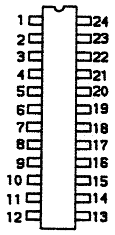


SELECT
VCC
STROBE
INPUTS
OUTPUT
1A
1B
1Y
2A
2B
2Y
4A
4B
4Y
3A
3B
3Y
GND

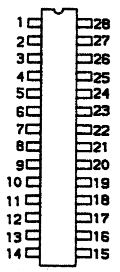
U54,U55
DATA SELECTOR/
MULTIPLEX
TOP VIEW



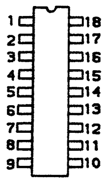
U56,U60,U64,
U72,U73,U83,U87,U101
U112,U130
TOP VIEQ



U67,U103,U117
TOP VIEW



U17,U27,U37,U47
TOP VIEW

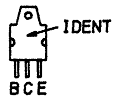


U18,U82

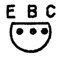
TOP VIEW

IC PINOUTS & TERMINAL GUIDES

POWER SUPPLY

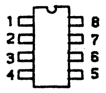


Q3,Q4
FRONT VIEW



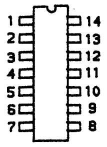
Q1

BOTTOM VIEW



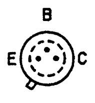
M6

TOP VIEW


1 14
2 13
3 12
4 11
5 10
6 9
7 8

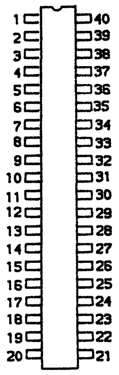
M1,M2,M5

TOP VIEW

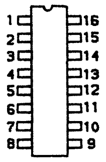


Q2
BOTTOM VIEW

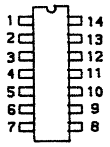
KEYBOARD


1 40
2 39
3 38
4 37
5 36
6 35
7 34
8 33
9 32
10 31
11 30
12 29
13 28
14 27
15 26
16 25
17 24
18 23
19 22
20 21

M5
TOP VIEW


1 16
2 15
3 14
4 13
5 12
6 11
7 10
8 9

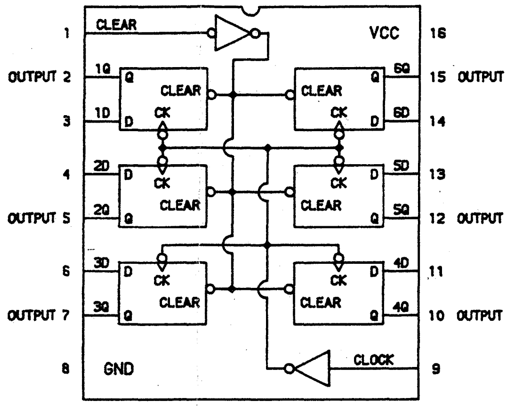
M4
TOP VIEW


1 14
2 13
3 12
4 11
5 10
6 9
7 8

M1,M2,M3,
M6,M7,U1
TOP VIEW

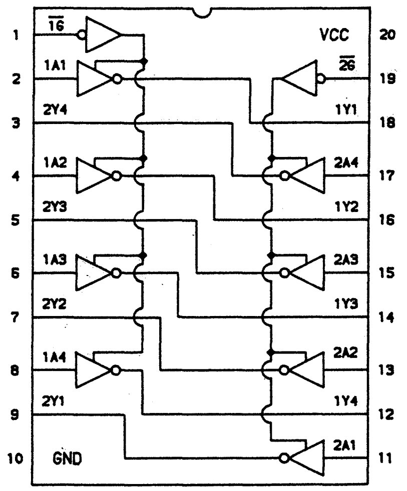
SERIAL/PARALLEL

SN74LS174N


1
CLEAR
VCC
16
OUTPUT 2
1Q
Q
CLEAR
6Q
15 OUTPUT
3
1D
D
CK
6D
14
4
2D
D
5D
13
OUTPUT 5
2Q
Q
5Q
12 OUTPUT
6
3D
4D
11
OUTPUT 7
3Q
4Q
10 OUTPUT
8
GND
CLOCK
9

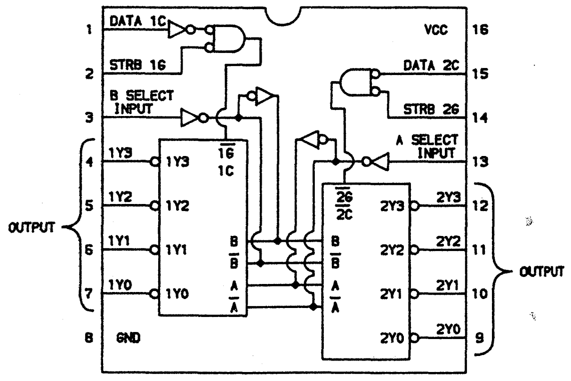
U4
OUTPUT CONTROL LATCH
TOP VIEW

SN74LS240N


1
1G
VCC
20
2
1A1
2G
19
3
2Y4
1Y1
18
4
1A2
2A4
17
5
2Y3
1Y2
16
6
1A3
2A3
15
7
2Y2
1Y3
14
8
1A4
2A2
13
9
2Y1
1Y4
12
10
GND
2A1
11

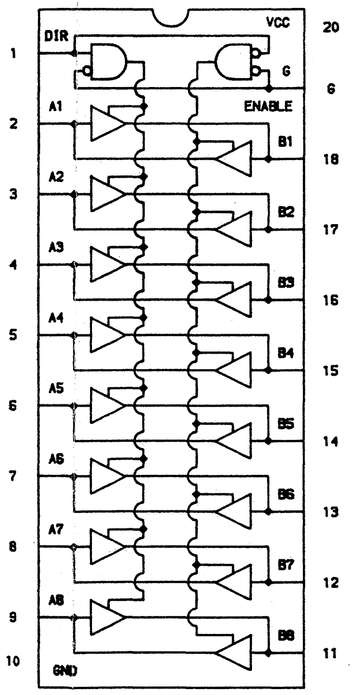
U8
INPUT CONTROL LATCH
TOP VIEW

SN74LS155AN


1
DATA 1C
VCC
16
2
STRB 16
DATA 2C
15
3
B SELECT INPUT
STRB 26
14
A SELECT INPUT
13
OUTPUT
4
1Y3
1Y3
16
1C
5
1Y2
1Y2
26
2C
2Y3
2Y3
12
6
1Y1
1Y1
B
B
2Y2
2Y2
11
OUTPUT
7
1Y0
1Y0
A
A
2Y1
2Y1
10
8
GND
2Y0
2Y0
9

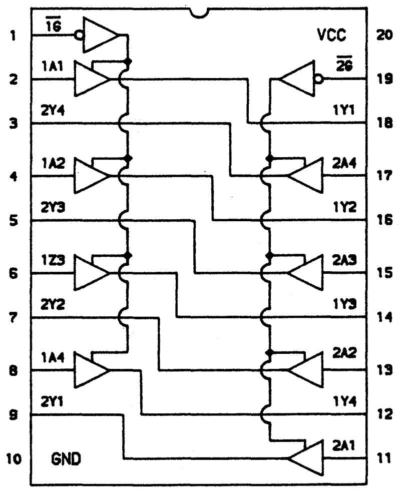
U12
DECODER
TOP VIEW

SN74LS245N

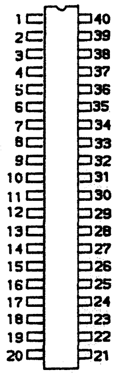

DIR
VCC
20
1
G
19
ENABLE
2
A1
B1
18
3
A2
B2
17
4
A3
B3
16
5
A4
B4
15
6
A5
B5
14
7
A6
B6
13
8
A7
B7
12
9
A8
B8
11
10
GND

U17
TRANSCEIVER
TOP VIEW

SN74LS244N

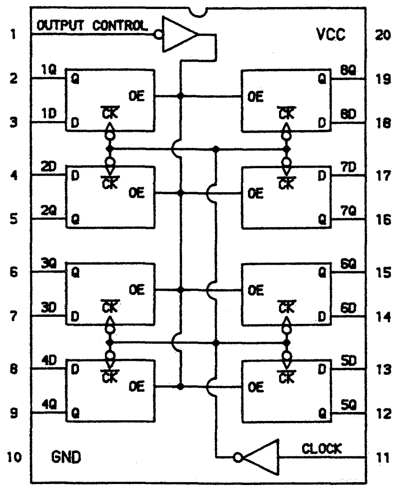

1
1G
VCC
20
2
1A1
2G
19
3
2Y4
1Y1
18
4
1A2
2A4
17
5
2Y3
1Y2
16
6
1Z3
2A3
15
7
2Y2
1Y3
14
8
1A4
2A2
13
9
2Y1
1Y4
12
10
GND
2A1
11

U9
INPUT DATA LATCH
TOP VIEW

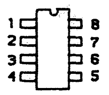

1 40
2 39
3 38
4 37
5 36
6 35
7 34
8 33
9 32
10 31
11 30
12 29
13 28
14 27
15 26
16 25
17 24
18 23
19 22
20 21

U5
TOP VIEW

SN74LS374N

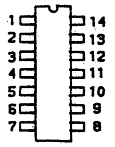

1
OUTPUT CONTROL
VCC
20
2
1Q
Q
OE
OE
8Q
19
3
1D
D
CK
CK
8D
18
4
2D
7D
17
5
2Q
7Q
16
6
3Q
6Q
15
7
3D
6D
14
8
4D
5D
13
9
4Q
5Q
12
10
GND
CLOCK
11

U18
OUTPUT DATA LATCH
TOP VIEW



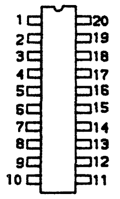
U6,U7

TOP VIEW

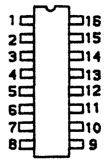

1 14
2 13
3 12
4 11
5 10
6 9
7 8

U1,U11,U15,U16

TOP VIEW

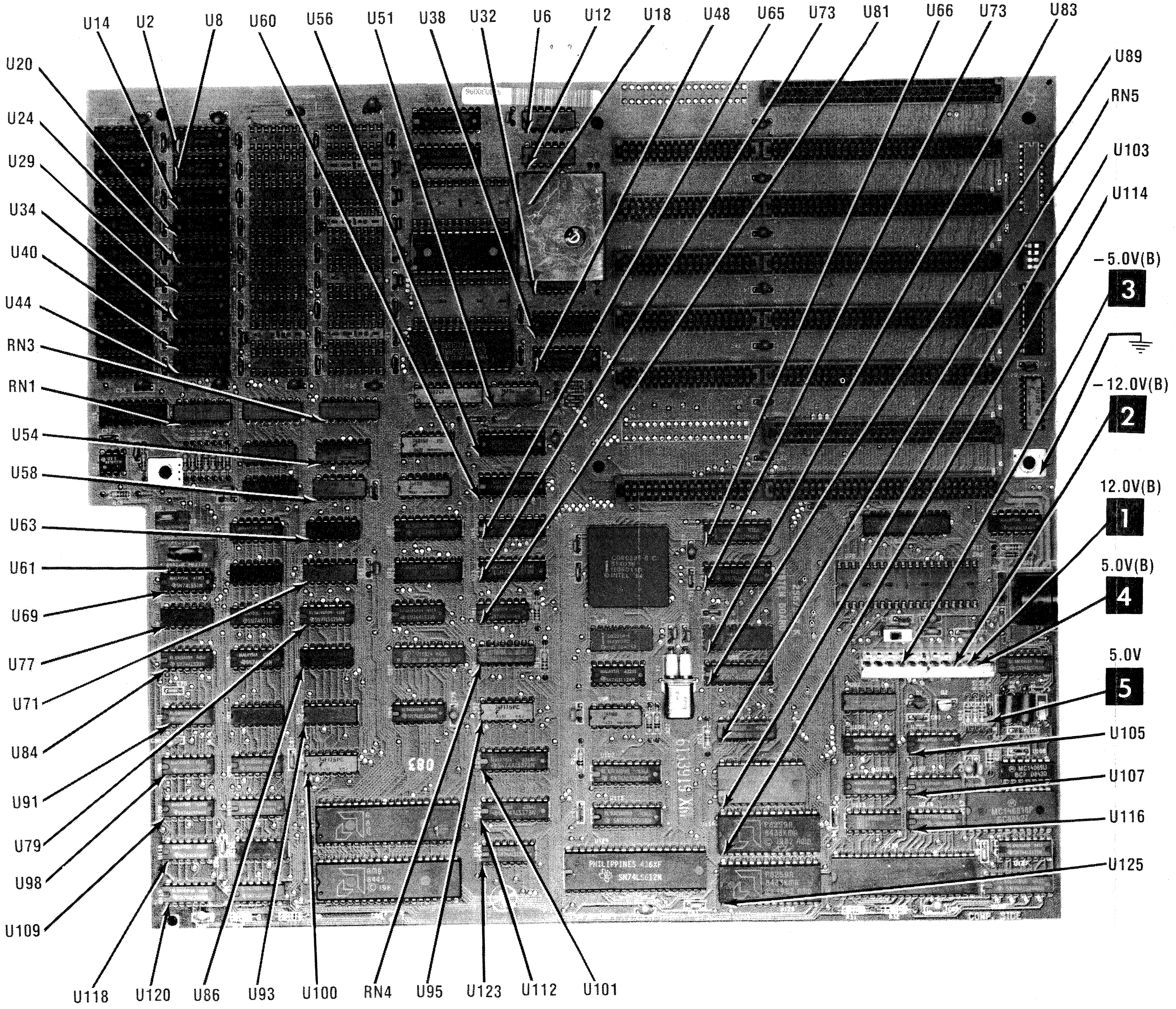

1 20
2 19
3 18
4 17
5 16
6 15
7 14
8 13
9 12
10 11

U14
TOP VIEW


1 16
2 15
3 14
4 13
5 12
6 11
7 10
8 9

U3,U13

TOP VIEW


U14
U2
U8
U60
U56
U51
U38
U32
U6
U12
U18
U48
U65
U73
U81
U66
U73
U83
U89
RN5
U103
U114
−5.0V(B)
3
−12.0V(B)
2
12.0V(B)
1
5.0V(B)
4
5.0V
5
U105
U107
U116
U125
U20
U24
U29
U34
U40
U44
RN3
RN1
U54
U58
U63
U61
U69
U77
U71
U84
U91
U79
U98
U109
U118
U120
U86
U93
U100
RN4
U95
U123
U112
U101

NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

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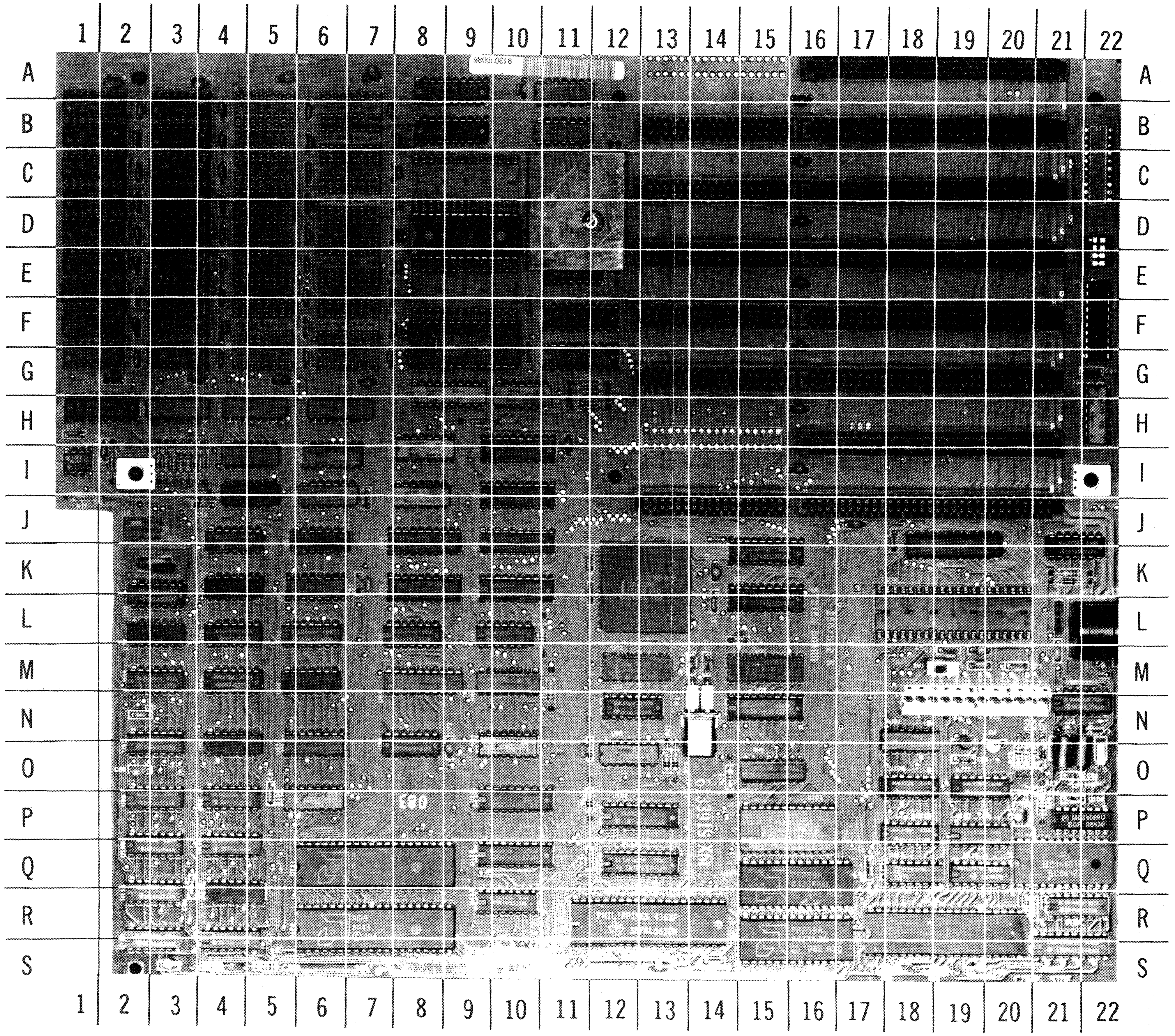
1
2
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6
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9
10
11
12
13
14
15
16
17
18
19
20
21
22
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S

A Howard W. Sams GRIDTRACE™ Photo

DISASSEMBLY INSTRUCTIONS

CABINET REMOVAL

Remove five screws from rear of cabinet. Slide cabinet forward and remove from unit.

POWER SUPPLY REMOVAL

Disconnect Connectors P8 and P9 from System Board and Connectors P10 and P11 from Disk Drives. Remove four screws from rear of the Power Supply cabinet. Push Power Supply forward about 1/2 inch to clear mounting tabs on cabinet bottom and lift Power Supply from unit.

FLOPPY DISK DRIVE REMOVAL

Disconnect Disk Drive Adapter Connector and ground Connector. Disconnect Power Supply Connector P11 from the rear of the Disk Drive. Remove two screws from the front of Disk Drive A and slide Disk Drive out the front of cabinet.

FIXED DISK DRIVE REMOVAL

Disconnect two Fixed Disk Drive Adapter Connectors, ground Connector and Power Supply Connector (P10) from rear of Fixed Disk Drive. Remove two screws from the front of Drive and slide Drive out front of cabinet.

SYSTEM BOARD REMOVAL

Remove all adapter boards from the expansion slots. Disconnect Battery Connector (J21), Power Supply Connectors (P8 and P9), Speaker Connector (J19) and security Key Lock Connector (J20). Remove two screws located at center top and center bottom on System Board. Slide System Board to left to clear plastic stand-offs on Chassis Bottom. Lift system board out of chassis.

KEYBOARD DISASSEMBLY

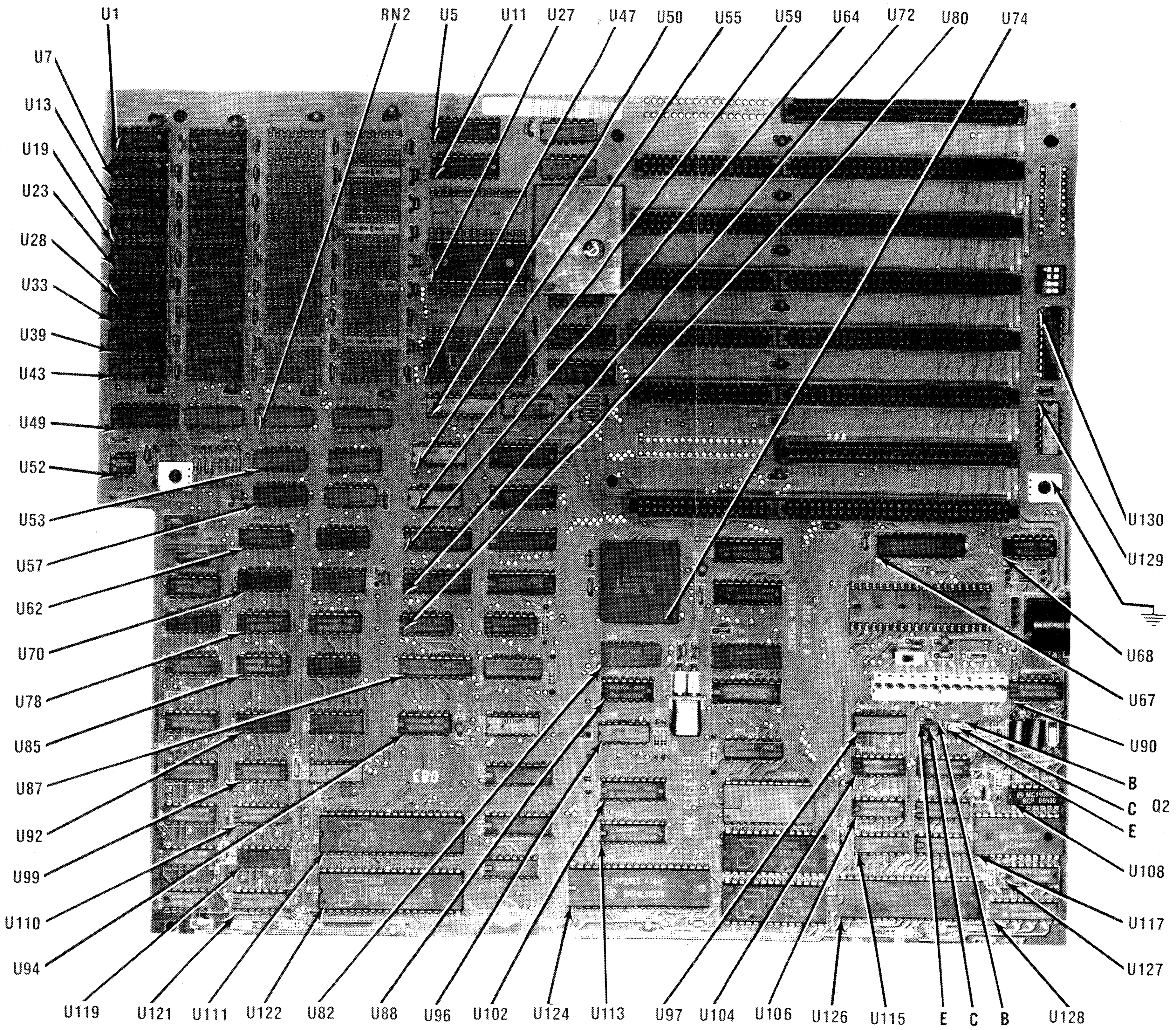
Lay Keyboard face down and remove four screws holding lower case. Carefully lift up on rear edge of lower case until it is high enough to slide keyboard cable out. Slide cable out of slot and continue lifting on rear edge until latching tabs on front edge release. The key caps may be removed by lifting up on cap from top of Keyboard.

POWER SUPPLY DISASSEMBLY

Drill out two rivets on front and top of Power Supply Cabinet. Remove one screw from top and three screws from front of cabinet and lift top off. Squeeze cable strain relief and slide out of cabinet. Remove four screws holding Fan. Disconnect AC power Connectors (E26 and E27) from Main Power Supply Board. Remove nut holding ground wire to cabinet. Remove three screws holding Main Power Supply Board and remove from cabinet. Unsolder five wires connected to AC Input Board. Remove three nuts holding AC Input Board and remove board.

SYSTEM BOARD GridTrace LOCATION GUIDE

C1	A-2	C77	M-20	R27	O-22	U82	M-2
C2	A-4	C78	M-21	R28	P-21	U83	M-14
C3	A-5	C79	O-9	R29	S-4	U84	N-2
C4	A-7	C80	O-11	R30	S-5	U85	N-4
C5	A-10	C81	O-19	R31	S-18	U86	N-5
C6	A-16	C83	P-21	R32	S-18	U87	N-7
C7	B-2	C84	P-20	R33	H-12	U88	N-12
C8	B-4	C85	P-20	R34	H-9	U89	N-14
C9	B-6	C86	O-2	RN1	H-3	U90	N-21
C10	B-7	C87	P-5	RN2	H-4	U91	O-2
C11	B-2	C88	R-3	RN3	H-6	U92	O-4
C12	B-4	C89	S-3	RN4	N-9	U93	O-5
C13	B-6	C90	S-7	RN5	O-15	U94	O-7
C14	B-8	C91	Q-12	SW1	M-19	U95	O-9
C15	C-16	C92	S-13	U1	B-1	U96	O-12
C16	C-2	C93	S-14	U2	B-3	U97	O-18
C17	C-4	C94	Q-17	U5	B-8	U98	P-2
C18	C-6	C95	S-19	U6	B-10	U99	P-4
C19	C-8	C96	R-2	U7	C-1	U100	P-5
C20	D-2	C97	G-22	U8	C-3	U101	P-9
C21	D-4	C98	C-11	U11	B-8	U102	P-12
C22	D-6	CR1	K-21	U12	B-10	U103	Q-15
C23	D-8	CR2	O-21	U13	C-1	U104	P-18
C26	D-12	FB1	O-21	U14	C-3	U105	P-19
C27	D-16	FB2	O-21	U18	C-11	U106	Q-18
C28	D-2	J1	A-21	U19	D-1	U107	Q-19
C29	D-4	J2	B-21	U20	D-3	U108	P-21
C30	D-6	J3	C-21	U23	D-1	U109	Q-2
C31	D-8	J4	E-21	U24	D-3	U110	Q-4
C32	E-2	J5	F-21	U27	E-8	U111	R-6
C33	E-4	J6	G-21	U28	E-1	U112	Q-9
C34	E-6	J7	H-21	U29	E-3	U113	Q-12
C35	E-8	J8	J-21	U32	E-11	U114	R-15
C36	F-10	J10	B-15	U33	F-1	U115	Q-18
C37	E-16	J11	C-15	U34	F-3	U116	Q-19
C38	E-2	J12	E-15	U38	F-11	U117	Q-20
C39	E-4	J13	F-15	U39	F-1	U118	R-2
C40	E-6	J14	G-15	U40	F-3	U119	R-4
C41	E-8	J16	J-15	U43	G-1	U120	S-2
C42	F-2	J18	J-2	U44	G-3	U121	S-4
C43	F-4	J19	J-2	U47	G-8	U122	S-6
C44	F-6	J20	J-2	U48	G-11	U123	R-9
C45	F-8	J21	L-21	U49	H-1	U124	S-11
C46	F-16	J22	L-22	U50	H-8	U125	S-15
C47	G-2	P58	N-21	U51	H-10	U126	S-17
C48	G-4	P59	N-19	U52	I-1	U127	R-21
C49	G-6	Q1	O-19	U53	I-4	U128	S-21
C50	G-7	Q2	O-20	U54	I-6	U129	G-22
C51	G-10	R1	D-12	U55	I-8	U130	E-22
C52	G-2	R2	C-12	U56	I-9	Y1	D-11
C53	G-4	R3	C-12	U57	J-4	Y2	N-14
C54	G-5	R4	E-12	U58	J-6	Y3	O-22
C55	G-7	R5	G-12	U59	J-8		
C56	H-16	R6	G-12	U60	J-9		
C57	H-1	R7	H-12	U61	K-2		
C58	I-2	R8	I-2	U62	K-4		
C59	J-4	R9	I-3	U63	K-6		
C60	H-11	R10	I-3	U64	K-7		
C61	J-7	R11	I-3	U65	K-9		
C62	I-16	R12	I-3	U66	K-14		
C63	J-17	R13	I-3	U67	K-18		
C64	J-18	R14	I-4	U68	K-21		
C65	K-7	R15	I-4	U69	L-2		
C66	K-12	R16	J-1	U70	L-4		
C67	K-12	R17	K-21	U71	L-5		
C68	K-14	R18	L-11	U72	L-7		
C69	L-14	R19	M-11	U73	L-9		
C70	N-2	R20	P-12	U74	L-13		
C71	M-14	R21	O-13	U75	L-14		
C72	M-14	R22	O-13	U77	M-2		
C73	L-15	R23	O-14	U78	M-4		
C74	M-19	R24	O-20	U79	M-5		
C75	M-19	R25	O-20	U80	M-7		
C76	M-19	R26	O-21	U81	M-9		


U1
RN2
U5
U11
U27
U47
U50
U55
U59
U64
U72
U80
U74
U7
U13
U19
U23
U28
U33
U39
U43
U49
U52
U53
U57
U62
U70
U78
U85
U87
U92
U99
U110
U94
U130
U129
U68
U67
U90
B
C
Q2
E
U108
U117
U127
U119
U121
U111
U122
U82
U88
U96
U102
U124
U113
U97
U104
U106
U126
U115
E
C
B
Q1
U128

NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

SWITCHES AND JUMPERS (Continued)

Enhanced Graphics and Monochrome/Printer Adapters are Installed in the System.
Enhanced Graphics Adapter is the Primary Adapter.

		SW1			
EGA Adapter	Monochrome/Printer Adapter	1	2	3	4
Color (40 x 25)	Monochrome or none	Closed	Open	Open	Closed
Color (80 x 25)	Monochrome or none	Open	Open	Open	Closed
Enhanced Color (Normal Mode)	Monochrome or none	Closed	Closed	Closed	Open
Enhanced Color (Enhanced Mode)	Monochrome or none	Open	Closed	Closed	Open

Enhanced Graphics and Monochrome/Printer Adapters are Installed in the System.
Monochrome/Printer Adapter is the Primary Adapter.

		SW1			
EGA Adapter	Monochrome/Printer Adapter	1	2	3	4
None	Monochrome	Open	Closed	Closed	Closed
Color (40 x 25)	Monochrome	Closed	Closed	Closed	Closed
Color (80 x 25)	Monochrome	Open	Closed	Closed	Closed
Enhanced Color (Normal Mode)	Monochrome	Closed	Open	Closed	Closed
Enhanced Color (Enhanced Mode)	Monochrome	Open	Open	Closed	Closed

Enhanced Graphics and Color Graphics Adapter are Installed on the System.
Enhanced Graphics Adapter is the Primary Adapter.

		SW1			
EGA Adapter	Color Graphics Adapter	1	2	3	4
Monochrome	None	Open	Open	Closed	Open
Monochrome	Color (40 x 25)	Closed	Open	Closed	Open
Monochrome	Color (80 x 25)	Open	Open	Closed	Open

Enhanced Graphics and Color Graphics Adapter are Installed in the System.
Color Graphics Adapter is the Primary Adapter.

		SW1			
EGA Adapter	Color Graphics Adapter	1	2	3	4
Monochrome	Color (40 x 25)	Closed	Closed	Open	Closed
Monochrome	Color (80 x 25)	Open	Closed	Open	Closed

MISCELLANEOUS ADJUSTMENTS

14MHz OSCILLATOR

Connect the input of a frequency counter to one end of Resistor R3. Adjust the 14MHz Adjust Trimmer (C26) for a frequency of 14.318MHz.

HEAD CLEANING INSTRUCTIONS

Use a lint-free cloth or cotton swab dampened with 91% isopropyl alcohol to clean the disk drive heads and dry with a lint-free cloth.

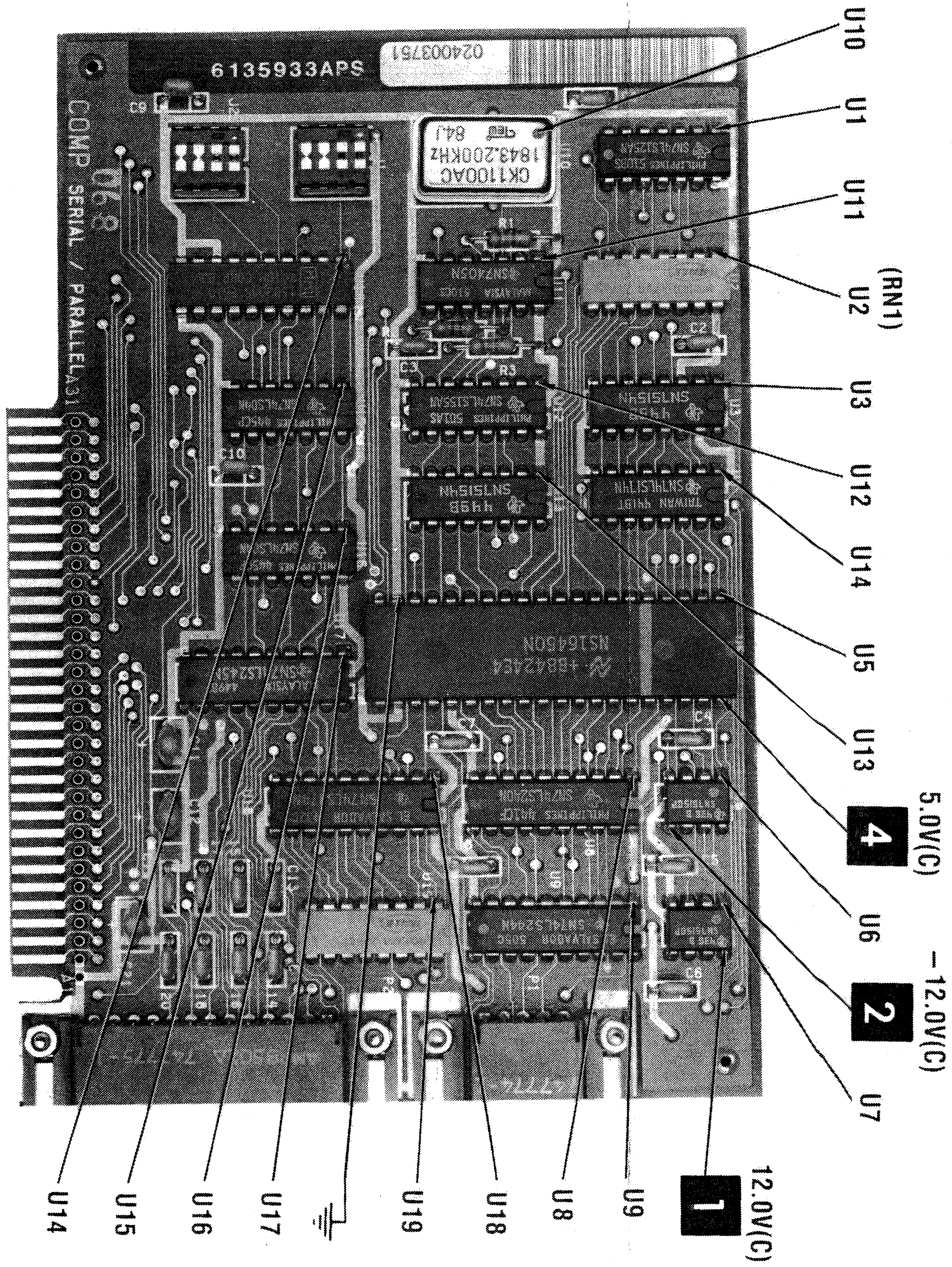
ALIGNMENT TOOLS

C26............GC Electronics 5000, 8276, 8089

5V ADJUSTMENT

Connect input of a voltmeter to 5.0V Source (pin 4 of Connector P9). Adjust 5.0V Adjust Control (P2) for a voltage of 5.0V.

NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED



CSCS17

IBM PC/AT
MODEL 5170-239

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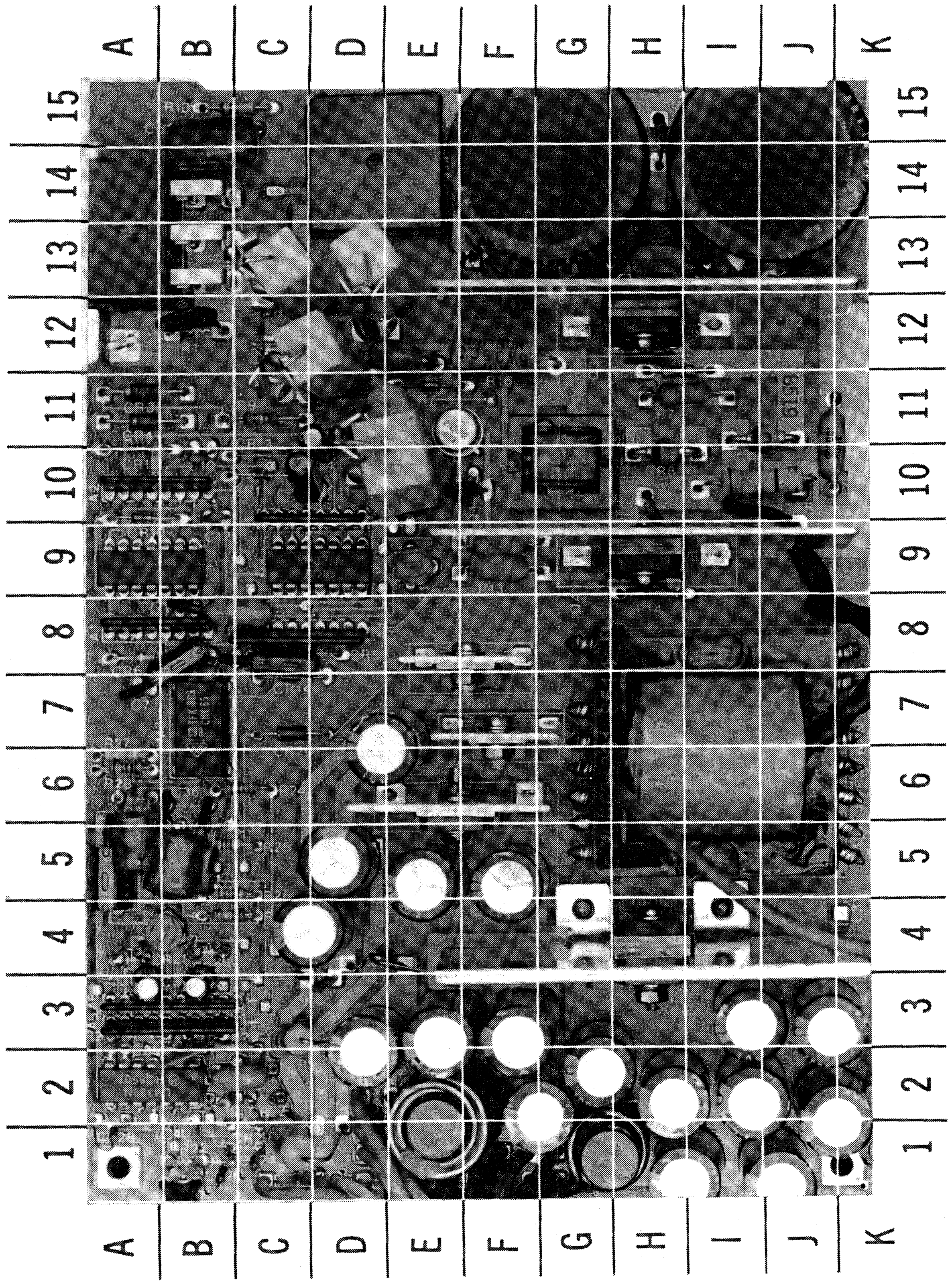


A Howard W. Sams GRIDTRACE™ Photo

SWITCHES AND JUMPERS

SYSTEM BOARD

Switch SW1

Switch SW1 is set according to type of Monitor that is used in the System.

SW1 On (Towards Front)	Color Graphics Monitor
SW 1 Off (Towards Rear)	Monochrome Monitor

Jumper J18

Jumper J18 is set according to the amount of RAM that is installed on the System Board.

J18	Pins 1 and 2 jumpered	512 K RAM
J18	Pins 2 and 3 jumpered	256 K RAM

Jumper J131

Jumper J131 is set according to the size of ROMS U17, U27, U37, and U47.

Four 16K x 8 ROMS used	J131 pins 1 to 8 and 2 to 7 jumpered
Two 32K x 8 ROMS used	J131 pins 3 to 6 and 4 to 5 jumpered

SERIAL/PARALLEL ADAPTER

Jumpers J1 and J2 are used to determine if the board is used as a Primary Serial or Parallel Port or an alternate Serial or Parallel Port.

Primary Serial Port	Connect J1 Pin 3 to 6 and 4 to 5
Alternate Serial Port	Connect J1 Pin 1 to 8 and 2 to 7
Primary Parallel Port	Connect J2 Pin 3 to 6 and 4 to 5
Alternate Parallel Port	Connect J2 Pin 1 to 8 and 2 to 7

ENHANCED GRAPHICS ADAPTER

Jumpers P1 and P3

Jumpers P1 and P3 are set according to the type of Monitor connected to the EGA Adapter. Set the jumpers to short the pins indicated below for the Monitor being used.

Monitor	P1	P3
Enhanced Color Monitor	1,2	1,2
Color or Monochrome Monitor	2,3	1,2

DIP Switch SW1

DIP Switch SW1 is set according to the types of Display Adapter boards and Monitors that are used in the System. One or two Display Adapter Boards and one or two Monitors can be used on the System. If two monitors are used, one must be a Color Monitor and the other a Monochrome Monitor. Two Monitors of the same type cannot be used in the same System. Use the following charts to determine the Switch settings for SW1 for the Adapter Boards and Monitors.

Enchanced Graphics Adapter is the only adapater installed in the System.

	SW1			
EGA Adapter	1	2	3	4
Monochrome	Open	Open	Closed	Open
Color (40 x 25)	Closed	Open	Open	Closed
Color (80 x 25)	Open	Open	Open	Closed
Enhanced Color (Normal Mode)	Closed	Closed	Closed	Open
Enhanced Color (Enhanced Mode)	Open	Closed	Closed	Open

COMPUTER SELF TESTS AND DIAGNOSTICS (Continued)

Last Four Character	IC	Last Four Characters	IC
0000	P	0100	8
0001	0	0200	9
0002	1	0400	10
0004	2	0800	11
0008	3	1000	12
0010	4	2000	13
0020	5	4000	14
0040	6	8000	15
0080	7		

SAFETY PRECAUTIONS

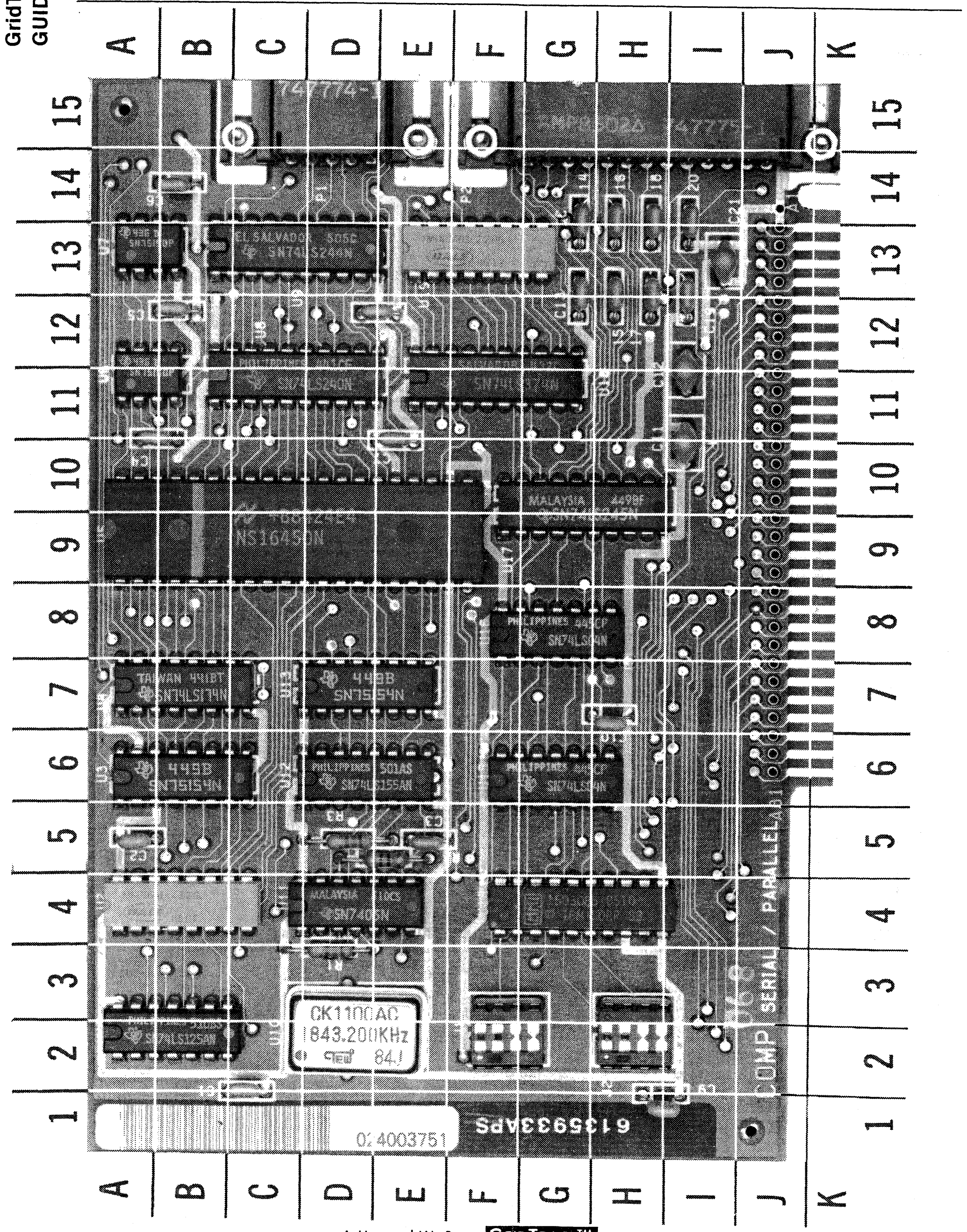
1. Use an isolation transformer for servicing.
2. Maintain AC line voltage at rated input.
3. Remove AC power from the Computer system before servicing or installing electrostatically sensitive devices. Examples of typical ES devices are integrated circuits and semiconductor "chip" components.
4. Use extreme caution when handling the printed circuit boards. Some semiconductor devices can be damaged easily by static electricity. Drain off any electrostatic charge on your body by touching a known earth ground. Wear a commercially available discharging wrist strap device. This should be removed prior to applying power to the unit under test.
5. Use a grounded-tip, low voltage soldering iron.
6. Use an isolation (times 10) probe on scope.
7. Do not remove or install boards, floppy disk drives, printers, or other peripherals with Computer system AC power On.
8. Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.
9. This Computer system is equipped with a grounded three-pronged AC plug. This plug must fit into a grounded AC power outlet. Do not defeat the AC plug safety feature.
10. Periodically examine the AC power cord for damaged or cracked insulation.
11. The Computer system cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.
12. Instructions should be given, especially to children, that objects should not be dropped or pushed into the vents of the cabinet. This could cause shock or equipment damage.
13. Never expose the Computer system to water. If exposed to water turn the unit Off. Do not place the Computer system near possible water sources.
14. Never leave the Computer system unattended or plugged into the AC outlet for long periods of time. Remove AC plug from AC outlet during lightning storms.
15. Do not allow anything to rest on AC power cord.
16. Unplug AC power cord from outlet before cleaning Computer system.
17. Never use liquids or aerosols directly on the Computer system. Spray on cloth and then apply to the Computer system cabinet. Make sure the Computer system is disconnected from the AC power line.

POWER SUPPLY GridTrace LOCATION GUIDE

A1	A-8
A2	A-10
A3	D-10
A4	C-8
A5	B-3
A6	B-3
C1	J-14
C2	G-14
C3	J-11
C4	D-11
C5	B-15
C6	C-8
C7	A-7
C8	E-12
C9	B-8
C10	B-10
C11	C-10
C12	B-10
C13	F-5
C14	E-5
C15	F-3
C16	E-3
C17	D-2
C18	J-1
C19	J-3
C20	J-1
C21	I-2
C22	I-3
C23	H-1
C24	H-2
C25	G-2
C26	F-2
C27	D-2
C28	D-5
C29	B-2
C30	C-4
C31	A-3
C32	C-2
C33	A-5
C34	B-3
C35	A-3
C36	B-5
C37	B-5
C38	A-5
C39	B-8
CR1	J-11
CR2	J-13
CR3	A-11
CR4	A-11
CR5	D-8
CR6	A-8
CR7	E-11
CR8	H-10
CR9	H-13
CR10	A-10
CR11	A-11
CR12	C-10
CR13	C-10
CR14	C-7
CR15	E-6
CR16	H-4
CR17	H-3
CR18	F-8
CR19	F-7
CR20	C-7
CR21	A-4
CR22	C-2
CR23	C-2
CR24	C-1
CR25	B-4
CR26	B-1
CR27	B-1
CR28	A-1
E26	C-12
E27	A-12
L1	E-1
L2	G-1
M1	A-9
M2	D-9
M3	B-7
M4	D-14
M5	A-2
M6	B-5
P1	E-9
P2	B-4
Q1	F-10
Q2	F-11
Q3	H-12
Q4	H-9
R1	B-12
R2	D-13
R3	C-13
R4	H-15
R5	F-13
R6	C-12
R7	I-11
R8	H-11
R9	C-11
R10	C-15
R11	E-10
R12	J-10
R13	F-9
R14	H-9
R15	E-11
R16	F-12
R17	D-4
R18	C-1
R19	B-2
R20	B-4
R21	A-3
R22	B-1
R23	B-3
R24	C-6
R25	B-5
R26	B-5
R27	A-6
R28	A-6
R29	C-3
R99	F-4
SW1	A-13
T1	G-10
T2	I-6

GridTrace LOCATION GUIDE

C1	C-1
C2	A-5
C3	E-5
C4	A-11
C5	B-12
C6	B-14
C7	E-11
C8	D-12
C9	I-1
C10	H-7
C11	I-10
C12	I-12
C13	G-13
C14	G-14
C15	H-13
C16	H-14
C17	H-13
C18	H-14
C19	I-13
C20	I-14
C21	I-13
J1	F-2
J2	H-2
P1	D-15
P2	H-15
P3	J-10
R1	D-3
R2	E-5
R3	D-3
U1	B-2
U2	B-4
U3	B-6
U4	B-7
U5	D-9
U6	A-11
U7	A-13
U8	C-11
U9	C-13
U10	D-2
U11	D-4
U12	D-6
U13	D-7
U14	G-4
U15	G-6
U16	G-8
U17	G-10
U18	F-11
U19	F-13



SERIAL/PARALLEL ADAPTER

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COMPUTER SELF TESTS AND DIAGNOSTICS

COMPUTER SELF-TEST

The Computer performs a self-test every time it is turned On. If no problems are detected, the Computer will beep once and boot up from the Floppy Disk Drive or the Fixed Disk Drive.

If a problem is detected various audio beeps may occur and/or an error code number may appear on the Monitor screen. Use the following charts to determine the area of the problem.

AUDIO	AREA OF PROBLEM
No beep or display	Power Supply
No beep and a blinking cursor.	Power Supply
Beeps continuously	Power Supply
Repeating short beeps	Power Supply
One long and two short beeps	Display Adapter
Two short beeps and Monitor display is blank or not correct	Display Adapter

(X = Alphanumeric character)

ERROR CODE	AREA OF PROBLEM
1XX	System Board
101	Interrupt Failure
151 or 161	New Battery (M1) installed or defective Battery
162	System Options Error, run Setup program
163	Date and Time not set, run Setup program
164	Memory Size Error
199	Option Setup Error, run Setup program
20X or XXXXXX XXXX 20X	Memory
30X or XX30X	Keyboard
301	Keyboard cable or Keyboard
XX301	Key Stuck
303 or 304	Keyboard Interface on System Board
4XX	Monochrome Display Adapter
5XX	Color/Graphics Display Adapter
6XX	Disk Drive
7XX	Math Coprocessor (U76)
9XX	Parallel Port on Serial/Parallel Adapter
10XX	Alternate Parallel Port on Serial/Parallel Adapter
11XX	Serial Port on Serial/Parallel Adapter
12XX	Alternate Serial Port on Serial/Parallel Adapter
13XX	Game Control Adapter
14XX	Graphics Printer
15XX	Synchronous Data Link Control (SDLC) Communications Adapter
17XX	Fixed (Hard) Disk Drive

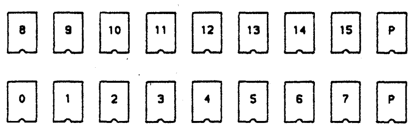
ERROR CODE	AREA OF PROBLEM
20XX	Binary Synchronous Communications (BSC) Adapter
21XX	Alternate BSC Adapter
29XX	Color Printer
Parity Check	Memory
Incorrect Memory Size Displayed	Memory
ROM Error	Defective ROM (U27, U47)
IO ROM XXXXXX	Defective IO Adapter

When a RAM failure occurs, an alphanumeric code will be displayed on the Monitor screen. This code will be 10 characters followed by 20X. The 20X number indicates it is a memory failure. The first two characters indicate which board and which bank on the board has the bad memory. Use the following chart to find the board.

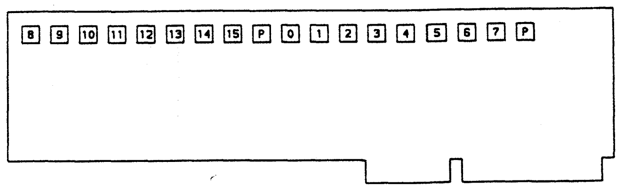
First Two Characters	Board	Bank
00,01,02,03	System	0
04,05, 06, 07	System	1
08 or 09	128K Memory Expansion	
10,11,12,13	1st 512K Memory Adapter	0
14,15,16,17	1st 512K Memory Adapter	1
18,19, 1A,1B	2nd 512K Memory Adapter	0
1C,1D,1E,1F	2nd 512K Memory Adapter	1
20,21,22,23	3rd 512K Memory Adapter	0
24,25,26,27	3rd 512K Memory Adapter	1
28,29,2A,2B	4th 512K Memory Adapter	0
2C,2D,2E,2F	4th 512K Memory Adapter	1
30,31,32,33	5th 512K Memory Adapter	0
34,35,36,37	5th 512K Memory Adapter	1

The last four characters indicate the failing IC. Use the following charts to locate the bad IC.

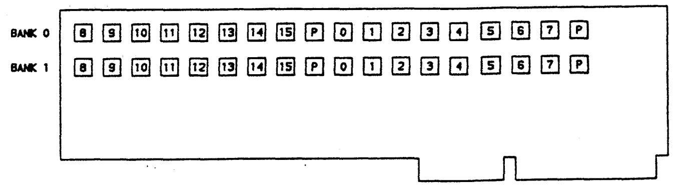
SYSTEM BOARD



128K MEMORY EXPANSION



512K MEMORY ADAPTER



GENERAL OPERATING INSTRUCTIONS

POWER ON TEST

A Power On test is automatically performed each time the Computer is turned On. Several diagnostic tests are performed and if a problem is detected, an error code will be displayed on the Monitor screen. For an explanation of the various error codes, see the "Computer Self-Test" section of the General Operating Instructions.

BOOT UP

Insert a bootable diskette into Disk Drive A and turn On the Computer. The Computer will automatically boot up using the diskette in Disk Drive A. If a PC DOS (Personal Computer Disk Operating System) diskette is used, the Computer will display the date and time and ask for a new date and time. After the date and time has been entered, the version of DOS will be displayed on the Monitor screen along with an A> which indicates the DOS is running. If Fixed (Hard) Disk Drive is installed, the Computer will boot up from the Fixed Drive if no diskette is inserted in the Floppy Disk Drive.

PC DOS

For a list of file names on the diskette in the current Disk Drive, type DIR and press the ENTER key. To specify Disk Drive that is not current (default), use DIR A: for Disk Drive A or DIR B: for Disk Drive B. If a Fixed (Hard) Disk Drive is installed, use DIR C:.

To return to PC DOS from Basic, type SYSTEM and press the ENTER key.

To load a (System) program from a diskette while in DOS, type the program name and press the ENTER key.

A blank diskette must be formatted before it can be used to save information which is in memory. A formatted diskette must contain a DOS or a Start-up program before the Computer can boot up using that diskette.

To format a blank diskette, insert a diskette containing a "Format Program" into Disk Drive A. Type FORMAT and press the ENTER key. Follow the instructions on the Monitor screen to format the unformatted diskette. NOTE: Formatting a diskette will wipe out any programs previously placed on the diskette. The Computer automatically defaults to the current Drive if the destination Disk Drive is not specified. Be sure to specify the destination Disk Drive of the diskette to be formatted or programs on the original diskette may be erased by the default action.

BASIC

When turned On, the Computer will come up in ROM Basic if there is not a bootable diskette in Disk Drive A and the Fixed (Hard) Disk Drive is not installed. If a Fixed Disk Drive is installed, the Computer will boot up from the Fixed Disk Drive if no diskette is inserted in the Floppy Disk Drive. If the Fixed Disk Drive does not contain a bootable program the Computer will come up in ROM Basic.

The manufacturer also supplies Disk Basic as well as Advanced Disk Basic on diskette. To load either Disk Basic, first boot up DOS. Insert a diskette with a Disk Basic or an Advanced Disk Basic program on it. Type BASIC and press the RETURN key to load Disk Basic or type BASICA and press the ENTER key to load Advanced Disk Basic. To return to DOS from Basic, type SYSTEM and press the ENTER key.

To view a list and the names of programs on a diskette in the current Drive, type FILES and press the ENTER key. Type FILES "B:" and press the ENTER key to list programs from Disk Drive B. Type FILES "A:" to list programs from Disk Drive A if it is not the current (default) drive. Type FILES "C:" to list programs from the Fixed Disk Drive if it is not the current drive.

To load a program in Disk Basic or Advanced Disk Basic from the diskette, type LOAD, the program name enclosed in quotes, and press the ENTER key. To load a program from a Disk Drive other than the default Drive, add the Drive letter with a colon in front of the program name.

LOAD"B:NAME"

To save a program, type SAVE, the program name enclosed in quotes and press the ENTER key. To save a program to a Disk Drive other than the default Drive, add the Drive letter with a colon in front of the program name.

SAVE"B:NAME"

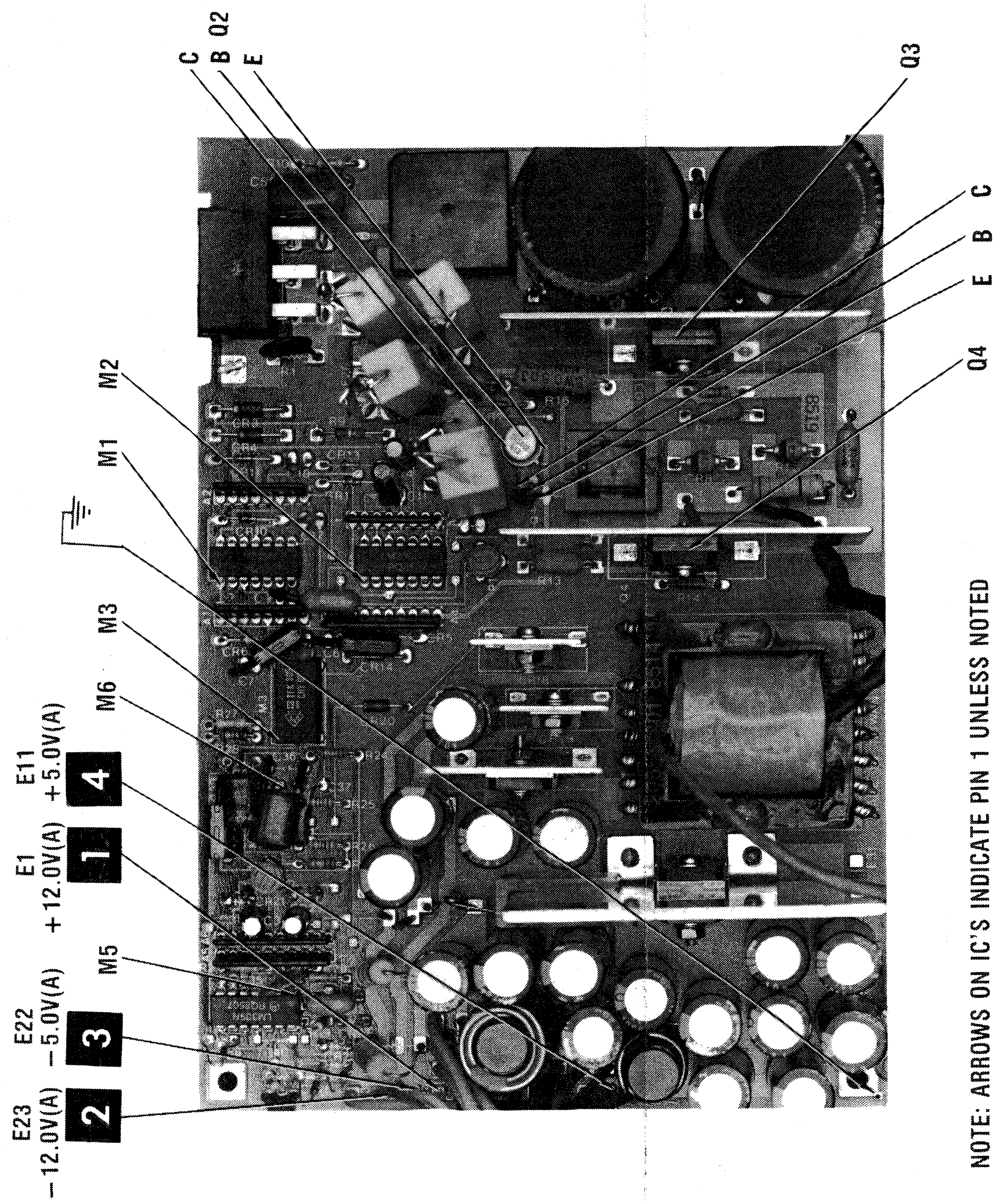
To run a program from Basic mode, type RUN and press the ENTER key. To stop a program, press the CTRL and BREAK (SCROLL LOCK) keys at the same time. NOTE: Some programs will disable or not recognize the CTRL and BREAK keys to prevent the user stopping the program while it is running.

RESETTING COMPUTER

Press the CTRL, ALT, and DEL keys, all three at the same time, to reset the Computer.

SYSTEM OPTIONS SETUP

Information on the time, date and the options that are installed in the Computer is stored in CMOS RAM IC (U117) that is powered by a Battery (M1) when the Computer is turned Off. If any option is removed or added to the Computer or the Battery (M1) is replaced, a Setup program must be run to put the time, date, and option information in the CMOS RAM. A Setup program is included on the Diagnostic Disk in the "Guide To Operations" manual that comes with the Computer. Insert the Diagnostic Disk in Drive A and turn the Computer On. A menu will come up on the Monitor screen listing the functions available. Select the Set up function (number 4) and follow the instructions on the screen to set the time, date, and options.



CSCS17

IBM PC/AT
MODEL 5170-239

NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

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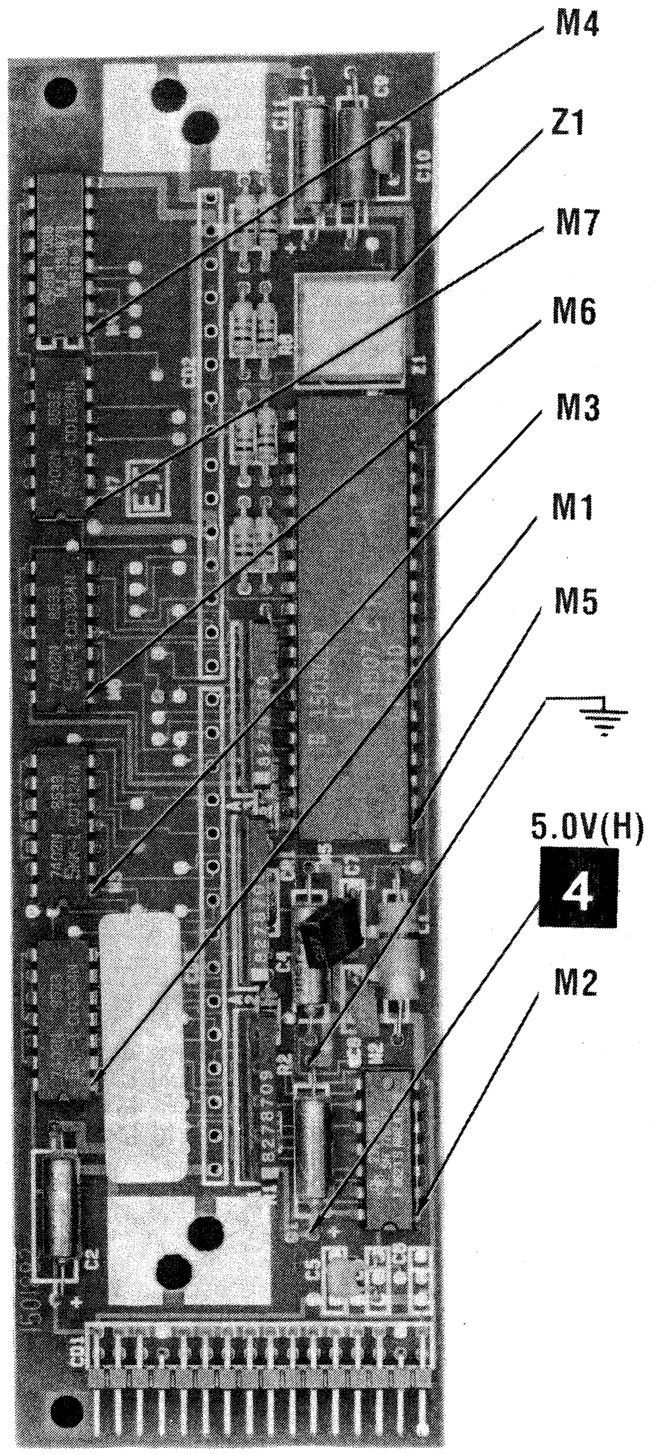
POWER SUPPLY



NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

A Howard W. Sams CIRCUITRACE® Photo

LINE DEFINITIONS (Continued)

RESCPU	Reset CPU
RESET	Reset
RESET 287	Reset 287
RESET DRV	Reset Drive
RG	Request Grant, Bus Control
S0,1	Status Lines
SA0 THRU SA19	Address Bits 0 Thru 19
SBEF	Sector Buffer Empty or Full
SEEK	Disk Seek
SEL	Select
SER I/O	Serial Input/Output
SHT DWN	Shut Down
SIDE	Disk Side
SMEMR	Serial Memory Read
SMEMW	Serial Memory Write
STEP	Stepper Motor
STEP 1 2	Stepper Motor Pulses
T/C	Transmitting/Complete
T/C CS	Timer Chip Select
TA0 THRU TA7	Address Bits 0 Thru 7
TC/B	Terminal Count/Bidirectional End of Process
TRACK 00	Track 00 Sensor
U12EN	U12 Enable
U19EN	U19 Enable
U22EN	U22 Enable
U37CLK	U37 Clock
U3EN	U3 Enable
U42EN	U42 Enable
U49CLK	U49 Clock
VCO EN	Voltage Controlled Oscillator Enable
VCO SEL	Voltage Controlled Oscillator Select
WAUP	Wake Up, Sector Buffer Full
WD	Write Data, Clock and Data for Diskete Writing
WD1010CS	Chip Select
WE	Write Enable
WG	Write Gate, Validation Before Diskette Writing
WR	Write, Data Bus Info Stored in Memory or I/O
WRCP	Clock Pulse
WRITE PROTECT	Write Protect, Disk Overwrite Protection
WRT DATA	Write Data
WRT EN	Write Enable
WRT PROT	Write Protect
XA0 THRU XA16	Address Bits 0 Thru 16
XBHE	Byte High Enable
XD0 THRU XD7	Data Bits 0 Thru 7
XIOR	Input/Output Read
XIOW	Input/Output Write
XMEMR	Memory Read
XMEMW	Memory Write

SCHEMATIC NOTES

—×— Circuitry not used in some versions
--- Circuitry used in some versions
⊖ See parts list
⏚ Ground
⫽ Chassis
▽ Common tie point

Voltages, waveforms, and logic readings taken with Computer in Power-Up Mode, no keys pressed, no diskette in Drive A, Fixed Disk Formatted with no programs on it. The following messages appear on the Monitor screen:

```
00256KB OK
161-System Options Not Set-(Run SETUP)
(RESUME="F1" KEY)
```

NOTE: The "System Options Not Set" message will appear if the battery pack in the system is disconnected causing the setup information stored in CMOS RAM (U117) to be lost.

Waveforms and voltages taken from ground, unless noted otherwise.

Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on "0" reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7.5cm. width with DC reference voltage given at the bottom line of each waveform.

Time in uSec. per cm, given with p-p reading at the end of each waveform.

Item numbers in rectangles appear in the alignment/adjustment instructions.

Supply voltage maintained as shown at input.

Voltages measured with digital meter, no signal.

Controls adjusted for normal operation.

Terminal identification may not be found on unit.

Capacitors are 50 volts or less, 5% unless noted.

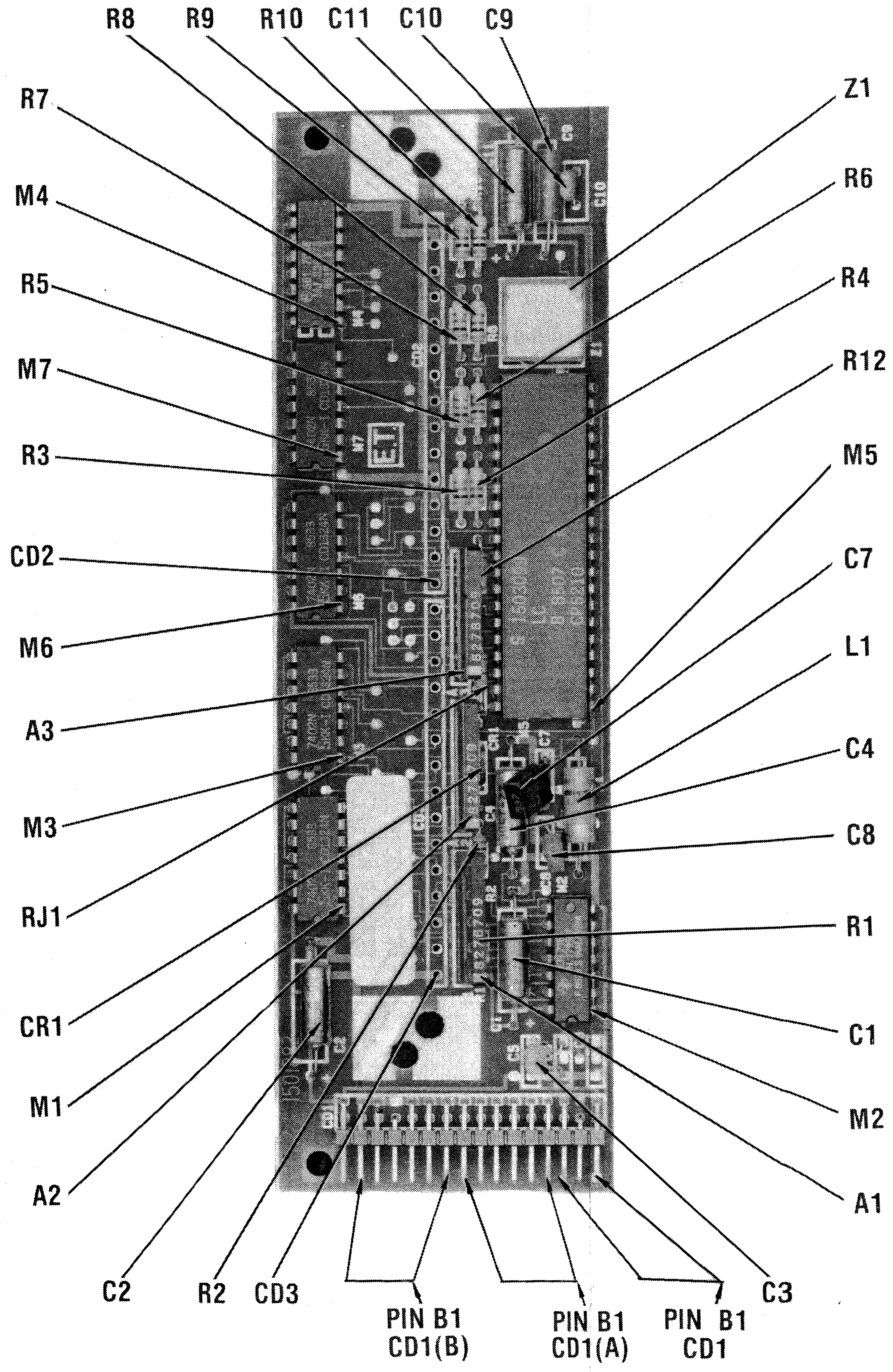
Value in () used in some versions.

Measurements with switching as shown, unless noted.

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No lights On)

LINE DEFINITIONS

258EN	258 Enable
258SEL	258 Select
8042 CS	8042 Chip Select
A0 THRU A23	Address, Bits 0 Thru 23
A20 GATE	Address Bit 20 Gate
ACK	Acknowledge
ADDR DEL	Address Select
AEN	Address Enable
AEN1,2	Address Enables 1,2
AIOW	Input/Output Write
ALE	Address Latch Enable
ALT ALE	Alternate Address Latch Enable
ARDY	Asynchronous Ready, Terminate Current Bus Cycle
ARDYEN	Asynchronous Ready Enable
BCS	Buffer Chip Select
BHE	Byte High Enable
BIOR	Input/Output Read
BUSY	Busy
BUSY286	Busy 286
C CLR	Clear
CASH0H,CAS1H	Column Address Strobe 0,1 High
CAS0L, CAS1L	Column Address Strobe 0,1 Low
CINC	Clock Timing Pulses
CLK	Clock Timing Pulses
CLK1	Clock 1
CMDLY	Command Delay, Delays Start of a Command
CMR	Counter Master Reset
CNTLOFF	Control Off, Command Enable/Address Enable
COMPLETE	Complete, Acknowledge
CONVALE	Address Latch Enable
CORRD	Read
CPU HLDA	CPU Hold Acknowledge
CS0,1	Chip Selects 0,1
CS16	Chip Select 16
CS287	Chip Select 287
D0 THRU D7	Data, Bits 0 Thru 7
DACK0,2,3,4,6,7	Direct Memory Access Acknowledge Lines
DATA 1 THRU DATA 8	Parallel Bits 1 Thru 8
DIR	Direction, Disk Read/Write Head
DIR 245	Direction, Data Control
DIR IN	Direction Input
DISK CHANGE	Disk Change
DISK DET	Disk Detection
DMA 1,2 CS	Direct Memory Access Chip Selects 1,2
DMA AEN	Direct Memory Access Address Enable
DMA CLK	Direct Memory Access Clock
DMA RDY	Direct Memory Access Ready
DRQ0,1,2,3	Direct Memory Access Request 0,1,2,3
DS	Disk Select
DS0,1,2,3	Drive Select Bits 0,1,2,3
DSB1	Hard or Floppy Disk Select
DT/R	Data Transmit/Receive
EIA CARRIER DET	Electronics Industries Assocation Carrier Detection
EIA CLR TO SEND	Electronics Industries Association Clear to Send
EIA DATA SET RDY	Electronics Industries Association Data Set Ready
EN	Enable
ENA IO	Enable Input/Output
ENA IO CK	Enable Input/Output Clock
ENB RAM	Enable RAM
ENB RAM PACK	Enable Random Access Memory Pack
END CYC	Terminate Cycle
ENDIR	Enable Direction
ERROR	Error Status, Unmasked Error Condition
FAULT	Error State
FDACK	Floppy Direct Memory Access Acknowledge
FDMAEN	Floppy DMA Enable
FDSEL	Floppy Drive Select
FFD	Fixed and Floppy Disk
FFD DATA	Fixed and Floppy Disk Data
FINT	Floppy Interrupt
FRCLK	Floppy Read Clock
FWCLK	Floppy Write Clock
GATE ALE	Gate Address Latch Enable
HDMAEN	Direct Memory Access Enable
HDRQ	Host Data Request
HLDA,HLDA1	Hold Acknowledge
HRQ1	Hold Request
HRST	Master Reset
HS0,1,2,3	Head and Drive Select Bits 0,1,2,3
HS3/RWC	Drive Select
I/O CH CK	Input/Output Clock
I/O CH RDY	Input/Output Ready
IN RDY	Input Ready
IND	Index Sensor
INDEX A	Index Sensor
INT	Interrupt
INTA	Interrupt Acknowledge
INTR 1,2, CS	Interrupt Request 1,2 Chip Select
IO CH RDY	Input/Output Ready
IO CS 16	Input/Output Write
IOR	Input/Output Read
IOW	Input/Output Write
IRQ	Interrupt Request
IRQ EN	Interrupt Request Enable
IRQ0 THRU IRQ14	Interrupt Request Lines 0 Thru 14
LOW DENSITY	Low Density Operating Mode
M ON	Motor On
M/IO	Select, Distinguishes Memory or I/O
MA0 THRU MA7	Memory Address Bits 0 Thru 7
MASTER	Master Reset
MD0 THRU MD15	Memory Data Bits 0 Thru 15
MEMCS16	Memory Chip Select 16
MEMR	Memory Read
MEMW	Memory Write
MINT	Interrupt Request, Activated by Master Reset
MOT EN1,2	Motor Enable 1,2
MOT ON	Motor Enable
MOTOR CONTROL	Drive Motor Control Pulses
NMI	Non-Maskable Interrupt
NMICS	Nonmaskable Interrupt Chip Select
NPCS	Numeric Processor Chip Select
OUT1,2	Outputs of Counters 1 and 2
OWS	Synchronous Ready
PCLK	Peripheral Clock
PG REG CS	Page Register Chip Select
PORTB RD	Port B Read
PORTB WR	Port B Write
POWER GOOD	Reset, Verifying Power On Situation
PPI CS	Peripheral Interface Chip Select
PRESET	Reset
PROCCLK	Processor Clock
R CLK	Clock
RA6	Register Counter, Overflow Detection
RAM 0,1,2,3 CAS	RAM 0,1,2,3 Column Address Strobe
RAM 0,1,2,3 RAS	RAM 0,1,2,3 Row Address Strobe
RAMSEL	RAM Select
RAS	Row Address Strobe
RCK	Reset Buffer Counters Request
RCS	RAM Chip Select
RD	Read
RD DATA	Read Data
RDY	Ready
READ EN	Read Enable
READY	Ready, Current Bus Cycle Is To Be Completed
REFRESH	Refresh Dynamic Memory Pulses



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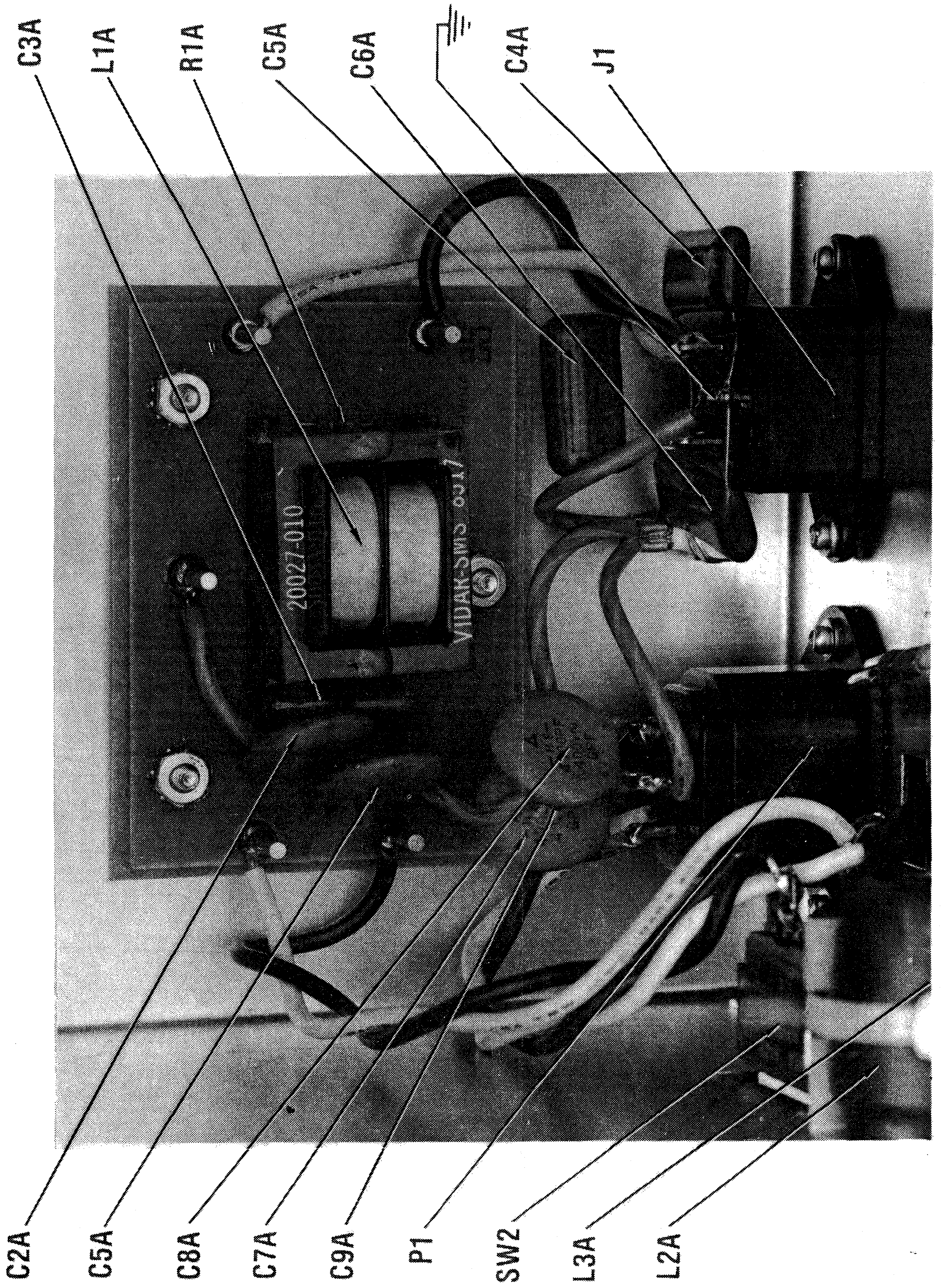
IBM PC/AT
MODEL 5170-239



AC INPUT BOARD

LOGIC CHART (Continued)

SYSTEM BOARD

PIN NO.	IC U128	IC U129	IC U130
1	H	L	L
2	L	L	*
3	P	P	H
4	L	L	P
5	P	*	P
6	H	*	P
7	P	H	P
8	P	L	H
9	P	H	P
10	L	*	L
11	L	*	L
12	P	H	H
13	L	*	L
14	P	*	L
15	L	P	H
16	P	H	H
17	L		L
18	P		L
19	*		H
20	H		H

KEYBOARD

PIN NO.	IC U1	IC M1	IC M2	IC M3	IC M4	IC M5	PIN NO.	IC M5	IC M6	IC M7	IC Z1	IC A1	IC A2	IC A3
1	L	P	L(1)	P	P	L(1)	21	L	P	P	H	H	H	H
2	H	P	H(1)	P	P	P	22	L	P	P	P	H	P	P
3	L	P	H(1)	P	P	P	23	L	P	P	P	L	P	P
4	H	P	L(1)	P	P	H	24	H	P	P	L	L	P	P
5	L	P	P	P	P	H	25	H	P	P	H	P	P	P
6	H	P	P	P	P	L(1)	26	H	P	P	H	P	P	P
7	L	L	L	L	P	L	27	P	L	L	L	P	P	P
8	*	P	P	P	L	H	28	P	P	P	*	P	P	P
9	L	P	P	P	P	H	29	H	P	P	L			
10	*	P	H(1)	P	P	P	30	H	P	P	L			
11	L	P	L(1)	P	P	P	31	H	P	P	L			
12	*	P	L(1)	P	P	P	32	H	P	P	L			
13	L	P	H(1)	P	P	P	33	H	P	P	L			
14	H	H	H	H	P	P	34	H	H	H	*			
15					P	P	35	H			P			
16					H	P	36	H			P			
17						P	37	L(1)			P			
18						P	38	L(1)			H			
19						P	39	P			L			
20						L	40	H			L			

LOGIC CHART (Continued)

SERIAL/PARALLEL ADAPTER

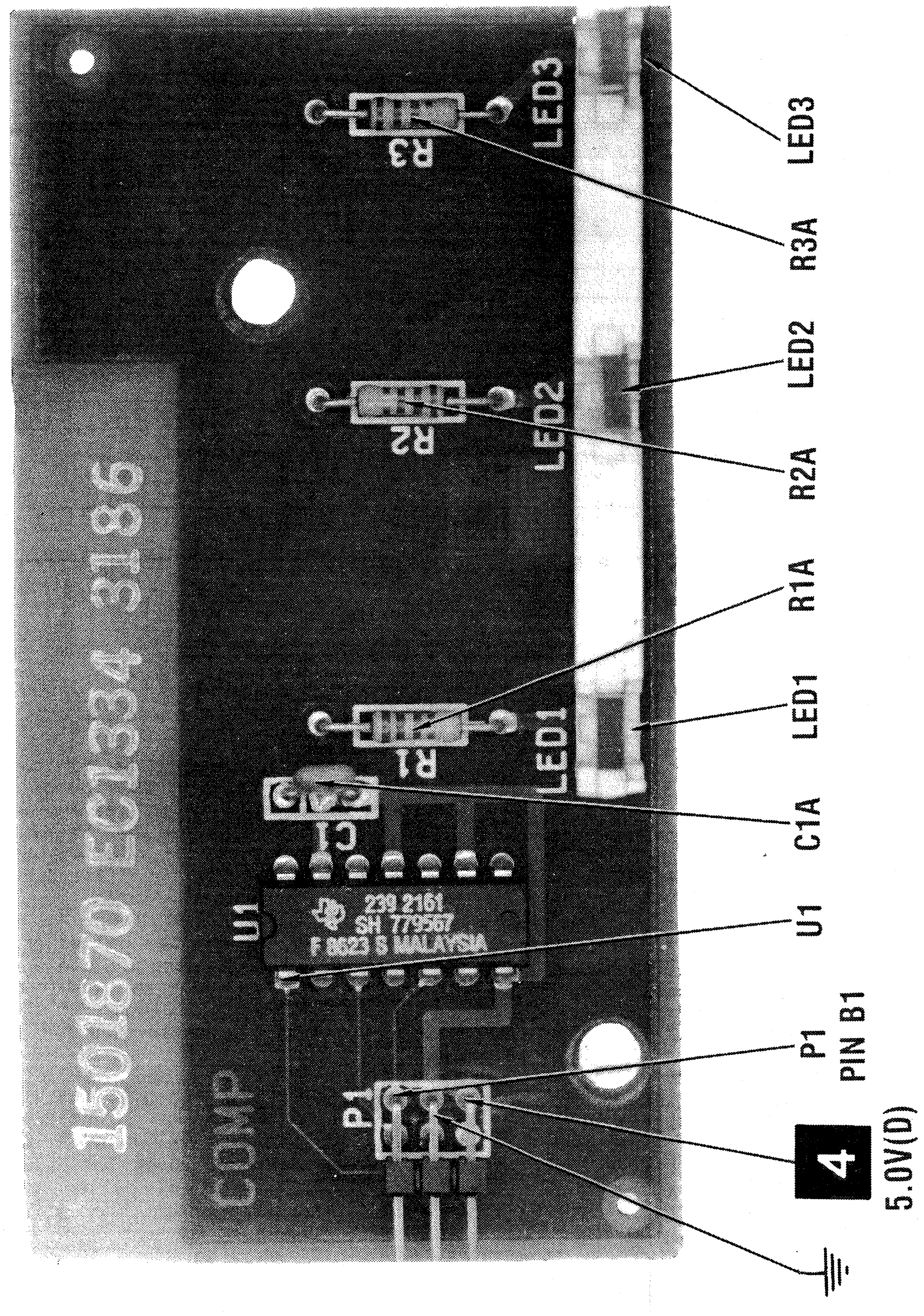
PIN NO.	IC U1	IC U3	IC U4	IC U5	PIN NO.	IC U5	IC U6	IC U7	IC U8	IC U9	IC U10	IC U11	IC U12	IC U13
1	H	L	H	P	21	H	H	H	H	H	*	P	L	H
2	L	L	L	P	22	L	H	H	H	H		P	H	H
3	H	H	P	P	23	H	*	H	P	P		P	P	H
4	H	L	P	P	24	P	L	L	L	L		P	H	L
5	*	L	H	P	25	L	L	L	P	P		L	H	L
6	P	L	P	P	26	P	L	L	L	L		H	H	L
7	L	L	L	P	27	P	L	L	P	P	L	L	H	L
8	P	L	L	P	28	P	H	H	H	H	P	L	L	L
9	L	H	H	P	29	*			P	P		H	H	H
10	H	H	L	H	30	L			L	L		H	H	H
11	H	H	P	H	31	H			*	L		L	H	H
12	H	H	H	H	32	H			P	P		H	H	H
13	H	H	P	H	33	H			L	H		L	P	H
14	H	L	P	P	34	H			P	P	H	H	P	H
15		H	L	P	35	L			L	H			H	H
16		L	H	P	36	H			P	P			H	L
17				P	37	H			L	L				
18				P	38	H			P	P				
19				L	39	H			H	H				
20				L	40	H			H	H				

PIN NO.	IC U14	IC U15	IC U16	IC U17	IC U18
1	P	P	H	H	L
2	P	P	L	P	H
3	P	H	L	P	P
4	P	L	H	P	P
5	P	P	L	P	L
6	P	P	H	P	L
7	P	L	L	P	P
8	L	L	L	P	P
9	L	*	*	P	H
10	L	H	L	L	L
11	L	L	H	P	H
12	*	L	L	P	L
13	*	H	*	P	P
14	P	H	H	P	P
15	H			P	H
16	H			P	H
17	P			P	P
18	P			P	P
19	*			L	L
20	H			H	H

CSCS17

IBM PC/AT
MODEL 5170-239

NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED



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TEST EQUIPMENT

Test Equipment listed by Manufacturer illustrates typical or equivalent equipment used by SAMS' Engineers to obtain measurements and is compatible with most types used by field service technicians.

TEST EQUIPMENT (COMPUTERFACTS)

Equipment	B & K Precision Equipment No.	Sencore Equipment No.	Notes
OSCILLOSCOPE	1570A,1590A,1596	SC61	
LOGIC PROBE	DP51,DP21		
LOGIC PULSER	DP101,DP31		
DIGITAL VOM	2830,2806	DVM37,DVM56,SC61	
ANALOG VOM	277,111,116		
ISOLATION TRANSFORMER	TR110,1604,1653,1655	PR57	
FREQUENCY COUNTER	1803,1805	FC71,SC61	
COLOR BAR GENERATOR	1211A,1251,1260,1249	CG25,VA62	
RGB GENERATOR	1260,1249		
FUNCTION GENERATOR	3020,3011,3030		
HI-VOLTAGE PROBE VOM/DMM Accessory probes	HV-44 PR-28(HV)	HP200	
TEMPERATURE PROBE	TP-28,TP-30		
CRT ANALYZER	467,470	CR70	
DIGITAL IC TESTER	560,550,552		
CAPACITANCE ANALYZER		LC53,LC75,LC76 LC77	
INDUCTANCE ANALYZER		LC53,LC75,LC76 LC77	

TROUBLESHOOTING

MICROPROCESSOR (CPU) OPERATION

Microprocessor IC (U74) does not appear to be functioning. Check the 12MHz waveform at pin 10 of Clock Generator IC (U82). If the waveform is missing, refer to the "Oscillator and Dividers" section of this Troubleshooting Guide. If the waveform is good, check the operation of the Reset circuit. Check the logic reading at pin 12 of IC U82 while turning Computer On. The reading should be logic High immediately after turning Computer On, then go logic Low after about .2 seconds. If the reading is not correct, check IC U82. If the reading is correct, check for a logic Low, that goes High .2 seconds after turning Computer On, at pin 4 of IC U99 and pin 4 of IC U116. If the reading is not correct at IC U99, check IC U99. If the reading is correct at IC U99 and not correct at IC U116, check IC U116. If the reading is correct at IC's U99 and U116, check for a logic High at pin 9 of IC U94. If the reading is not correct, check IC's U105 and U106. If the reading is correct, check for a logic High, that goes Low .2 seconds after turning Computer On, at pin 8 of IC U94. If the reading is not correct, check IC U94.

OSCILLATOR AND DIVIDERS

12MHz Oscillator. Check for a logic High Power Good signal at pin 11 of Clock Generator IC (U82). If the reading is not correct, refer to the "Power Supply" section of this Troubleshooting Guide. If the reading is correct, check for a 12.0MHz waveform at pin 10 of IC U82. If the waveform is missing, check Crystal Y2, Capacitors C71 and C72 and IC U82. If the waveform is good, check for 12.0 MHz pulses at pin 11 of IC U96. If pulses are missing, check IC U96. If pulses are present, check for a 6MHz waveform at pin 9 of IC U88 and pin 5 of IC U51. If the waveform is missing at IC U88, check IC U88. If the waveform is missing at IC U51, check IC U51.

14.318MHz Oscillator. Check for a 14.318 MHz waveform at pin 12 of IC U18. If the waveform is missing, check Crystal Y1, Trimmer Capacitor C26, IC U18 and Resistors R1 and R2. If the waveform is good, check for 2.38MHz pulses at pin 1 of IC U88. If pulses are missing, check IC U18. If pulses are present, check for 1.19MHz waveform at pin 5 of IC U88. If the waveform is missing, check IC U88.

32.768KHz Oscillator. Check for a 32.768KHz waveform at pin 10 of IC U108. If the waveform is missing, check Crystal Y3, Capacitor C83, IC U108 and Resistor R27.

KEYBOARD

Keyboard dead. Disconnect the keyboard and check the logic readings at pins 1 and 2 of

LOGIC CHART (Continued)

SYSTEM BOARD

PIN NO.	IC U113	IC U114	PIN NO.	IC U114	IC U115	IC U116	IC U117	PIN NO.	IC U117	IC U118	IC U119	IC U120	IC U121
1	P	P	21	H	H	P	*	21	P	H	L	L	L
2	P	P	22	H	H	P	P	22	H	P	P	L	H
3	P	H	23	H	H	H	P	23	L	P	P	H	P
4	P	P	24	H	P	H	P	24	H	H	P	H	P
5	P	P	25	H	H	H	P			P	P	P	P
6	P	P	26	P	H	H	P			P	*	P	P
7	P	P	27	P	H	L	P			L	H	L	L
8	P	P	28	H	L	H	P			L	L	P	P
9	P	P			P	H	P			H	P	P	P
10	L	P			P	P	P			H	H	P	L
11	P	P			P	P	P			H	*	P	H
12	P	L			P	P	L			P	L	P	P
13	P	L			H	P	L			H	L	P	P
14	P	L			P	H	L			H	L	H	H
15	P	L			L		H				L		
16	P	H			H		*				H		
17	P	P					H						
18	P	P					H						
19	P	L					H						
20	H	L					H						

PIN NO.	IC U122	PIN NO.	IC U122	IC U123	IC U124	PIN NO.	IC U124	IC U125	PIN NO.	IC U125	IC U126	PIN NO.	IC U126	IC U127
1	H	21	P	P	P	21	P	H	21	H	H	21	H	H
2	P	22	P	P	H	22	P	P	22	H	P	22	L	L
3	H	23	P	P	P	23	P	H	23	L	P	23	H	H
4	P	24	H	P	P	24	L	P	24	L	H	24	H	P
5	H	25	H	P	P	25	L	P	25	H	H	25	H	P
6	H	26	P	P	L	26	L	P	26	P	P	26	H	H
7	L	27	P	H	P	27	L	P	27	P	L	27	H	L
8	L	28	P	L	P	28	H	P	28	H	H	28	H	L
9	L	29	P	H	P	29	P	P			P	29	H	H
10	L	30	P	H	P	30	P	P			P	30	H	L
11	H	31	H	P	P	31	L	P			P	31	L	H
12	P	32	P	P	P	32	L	L			P	32	H	P
13	L	33	P	P	L	33	L	L			P	33	L	P
14	H	34	P	P	L	34	L	L			P	34	H	H
15	H	35	P	P	P	35	H	L			P	35	L	L
16	*	36	H	H	P	36	P	L			P	36	L	H
17	*	37	P		P	37	H	L			P	37	L	
18	*	38	P		L	38	P	L			P	38	H	
19	L	39	P		P	39	P	H			P	39	H	
20	L	40	P		L	40	H	H			L	40	H	

LOGIC CHART (Continued)

SYSTEM BOARD

PIN NO.	IC U91	IC U92	IC U93	IC U94	IC U95	IC U96	IC U97	IC U98	IC U99	IC U100	IC U101	IC U102
1	L	L	P	L	H	H	H	H	L	H	H	P
2	L	H	P	H	P	L	P	H	H	L	P	P
3	H	L	P	H	P	H	P	P	P	H	P	P
4	H	P	*	H	P	H	P	P	L	L	P	P
5	L	P	P	H	P	H	H	P	L	L	P	P
6	L	P	*	L	P	L	P	P	L	H	P	P
7	L	L	P	L	P	L	L	L	L	L	P	P
8	P	L	L	L	L	P	P	H	H	L	P	P
9	P	L	P	H	P	P	P	H	H	P	P	P
10	P	H	P	H	P	P	P	L	L	L	L	L
11	L	P	P	P	P	P	P	H	P	H	L	P
12	P	P	P	P	P	P	P	L	P	L	P	P
13	P	H	P	H	P	P	P	H	P	L	P	P
14	H	H	P	H	P	H	H	H	H	H	P	P
15			P		P					L	P	P
16			H		H					H	P	P
17											P	P
18											P	P
19											P	P
20											H	H

PIN NO.	IC U103	PIN NO.	IC U103	IC U104	IC U105	IC U106	IC U107	IC U108	IC U109	IC U110	IC U111	PIN NO.	IC U111	IC U112
1	P	21	P	H	H	H	L	H	H	H	H	21	P	H
2	P	22	H	P	L	H	H	L	H	H	P	22	P	P
3	P	23	P	P	P	P	H	L	H	H	H	23	P	P
4	P	24	H	H	H	H	L	H	H	H	P	24	H	P
5	P			P	L	H	L	L	L	H	H	25	H	P
6	P			P	H	L	H	H	H	H	H	26	P	P
7	P			L	L	L	L	L	L	L	L	27	P	P
8	P			H	H	H	L	P	H	L	L	28	P	P
9	P			L	L	L	H	P	L	P	L	29	P	P
10	P			H	H	H	L	P	H	P	L	30	P	L
11	H			P	P	P	H	P	L	P	P	31	H	L
12	L			P	P	L	P	P	H	H	P	32	P	P
13	P			L	H	H	P	H	L	P	L	33	P	P
14	H			H	H	H	H	H	H	H	H	34	P	P
15	P										H	35	P	P
16	L										*	36	H	P
17	H										L	37	P	P
18	P										*	38	P	P
19	P										*	39	P	P
20	P										L	40	P	H

TROUBLESHOOTING (Continued)

Keyboard Connector (J22) while turning Computer On. Pin 1 of Connector J22 should pulse three times in 15 seconds after Computer is turn On and pin 2 should pulse once about 16 seconds after Computer is turned On. If the logic readings are not correct at pin 1 of Connector J22, check IC's U116, U120 and U126. If the logic readings are not correct at pin 2 of Connector J22, check IC's U116 and U126. If the logic readings are correct at Connector J22, turn Computer Off and connect the keyboard. NOTE: Keyboard will work by itself if a separate 5V power source is used to power Keyboard. Connect the 5V lead from Power Supply to pin B1 of Connector CD1 on the Keyboard and the ground lead to pin A2 of Connector CD1.

Check the 5.3MHz waveform at pin 3 of Keyboard Controller IC (M5). If the waveform is missing, check Capacitors C7 and C8, Coil L1 and IC M5. If the waveform is good, check the waveforms at pins 15 thru 18 and check for pulses at pin 19 of IC M5. If the waveforms or logic readings are not correct, check IC M5. If the waveforms and logic reading are correct, check for pulses at pins 4 thru 7 and 9 thru 12 of Buffer IC (M4). If the readings are not correct, check IC M4. If the reading is correct, check for pulses at pins 6 and 8 of IC M2 while pressing a key. If pulses are missing, check IC M2. If pulses are present, check for pulses at pins 2 and 10 of IC M2 and 37 and 38 of IC M5 while pressing a key. If pulses are present at pins 37 and 38 of IC M5 and missing at pins 2 and 10 of IC M2, check IC M2. If pulses are missing at pins 37 and 38 of IC M5, check IC's M1, M3, M5, M6, and M7 and Sense Amplifier Module (Z1).

SOUND (INTERNAL SPEAKER)

No sound from the Speaker. Check Speaker Connector J19 for good connections and check the Speaker (SP1). If the Speaker and Connector check good, type in the following Basic program:

```
10 SOUND 200,20:GOTO 10
```

Monitor the logic reading on pin 9 of Flip/Flop IC (U127) while starting the above program. A pulse should appear as soon as the program is started, then the reading should go High and stay High. If the reading is not correct, ckeck IC U115. If the reading is correct, check for a logic High at pins 7 and 10 of IC U127 while the program is running. If the readings are not correct, check for pulses at pins 2 and 3 of IC U92 while the program is running. If pulses are missing at pin 2, check Timer IC (U103). If pulses are present at pin 2 and missing at pin 3, check IC U92. If pulses are present at pin 3, check Driver IC (U52), Capacitor C58 and Resistor R8.

REAL TIME CLOCK

Time has to be reset every time the Computer is turned On. Check the 6V Battery (M1), Diodes CR1 and CR2, Capacitor C84 and check Connector J21 for good connections. Time function or Options Setup Program, see "General Operating Instructions", does not work. Check the 32.768KHz waveform at pin 10 of IC U108. If the waveform is good, check Crystal Y3, Capacitor C83, IC U108 and Resistor R27. If the waveform is good, check for a logic High at pin 1 and a logic Low at pin 2 of IC U108. If the reading is not correct at pin 1, refer to the "Power Supply" section of this Troubleshooting Guide. If the reading is not correct at pin 2 of IC U108, check IC U108. If the readings are correct, type in and run the following Basic program. The program reads the seconds registered in the Clock/RAM IC (U117) and displays the results on the Monitor screen. The number that appears on the Monitor should change once a second.

```
10 OUT 112,0:PRINT INP(113):GOTO 10
```

While the program is running, check for pulses at pins 2 and 9 and a logic Low at pin 3 of PROM IC (U115). If the readings are not correct, check IC U115. If the readings are correct, check for a logic Low at pin 2 of IC U80. If the reading is not correct, check IC U104. If the reading is correct, check for pulses at pins 1 and 3 of IC U80. If pulses are missing at pin 1, check IC U110. If pulses are present at pin 1 and missing at pin 3, check IC U80. If pulses are present at pin 3, check IC U117.

Battery Switch Transistor (Q2) prevents the Battery (M1) from powering all the circuits on the System Board except IC's U108 and U117 when Computer is turned Off. To check the operation of Transistor Q2, check for 0V on the emitter of Transistor Q2 when the Computer is turned Off and Battery M1 is connected. Then disconnect Battery M1, turn On Computer, and check for 5.0V on the collector of Transistor Q2. If the readings are not correct, check Transistors Q1 and Q2 and Resistors R24, R25, and R26.

NOTE: When Battery M1 is disconnected, information stored in IC U117 will be lost. An Options Setup program must be used to restore the information. See "General Operating Instructions" (Systems Option Setup) for more details.

PARALLEL PORT (Serial/Parallel Adapter)

Parallel Port not working. Check the Edge Connector and Connector P2 for good connections. If the connections check good, plug a parallel loopback plug, see "Test Plugs", into connector P2 and type in and run the following Basic program. NOTE: Set Jumper J2 to configure the parallel port as the primary parallel port, see "Switches and Jumpers".

```
 10 CLS
 20 LOCATE 1,1
 30 OUT 888,0:OUT 890,0
 40 PRINT"A=";INP(888)
 50 PRINT"B=";INP(889)
 60 PRINT"C=";INP(890)
 70 OUT 888,255:OUT 890,255
 80 PRINT"D=";INP(888)
 90 PRINT"E=";INP(889)
100 PRINT"F=";INP(890):GOTO 20
```

TROUBLESHOOTING (Continued)

The program continuously checks the Parallel Interface Circuits and displays six numbers (A thru F) on the Monitor screen. With the loopback plug plugged into Connector P2, the following numbers should appear on the Monitor screen.

A = 0
B = 55
C = 224
D = 255
E = 207
F = 255

If any of the numbers are not correct, make the following checks with the loopback plug installed and the above program running. Check for pulses at pins 15 and 16 of Decoder IC (U14). If pulses are missing, check IC U14. If pulses are present, check for pulses at pins 11 thru 18 of Transceiver IC (U17). If pulses are missing, check IC U17. If pulses are present, check for pulses at pins 5, 6, 7, 9, and 11 of Decoder IC (U12). If pulses are missing, check IC U12. If pulses are present, check for pulses at pins 2, 5, 6, 9, 12, 15, 16, and 19 of Output Data Latch IC (U18). If pulses are missing, check IC U18. If pulses are present, check for a logic High at pin 10 of IC U15. If the reading is not correct, check IC U15. If the reading is correct, check for pulses at pins 2, 5, 7, 12, and 15 of Output Control Latch IC (U4). If pulses are missing, check IC U4. If pulses are present, check for pulses at pin 12 of IC U15. If pulses are missing, check IC U15. If pulses are present, check for pulses at pins 6, 8, 10, and 12 of IC U11. If pulses are missing, check IC U11. If pulses are present, check for pulses at pins 2, 4, 8, 10, and 12 of IC U16. If pulses are missing, check IC U16. If pulses are present and numbers A or D on the Monitor screen are not correct, check Input Data Latch IC (U9). If numbers B, C, E, or F are not correct, check the Input Control Latch IC (U8) and IC U1.

SERIAL PORT (Serial/Parallel Adapter)

Serial Port does not work. Check edge Connector and Connector P1 for good connections. Check for 1.8432MHz pulses at pin 16 of Serial Interface IC (U5). If pulses are missing, check 1.8432 MHz Oscillator Module (U10) and check IC U11. If the frequency is not correct, check Module U10. If pulses are present at pin 16 of IC U5, type in and run the following Basic program:

```
10 OUT 1019,131
20 OUT 1016,128:OUT 1017,1
30 OUT 1019,3
40 OUT 1020,0:OUT 1020,15
50 OUT 1016,255:GOTO 40
```

The program sets the baud rate to 300 baud and produces pulses at pins 11, 31, 32, 33, and 34 of IC U5. The waveform shown in Figure A should appear at pin 11 of IC U5. The waveform shown in Figure B should appear at pin 15 of IC U5, and the waveform shown in Figure C should appear at pins 31 thru 34 of IC U5.

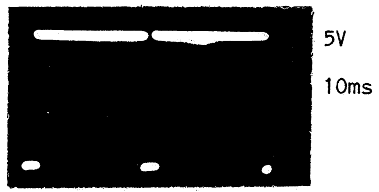


Figure A

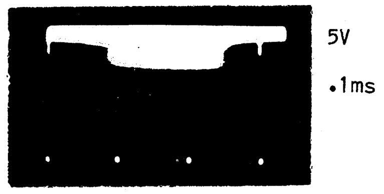


Figure B

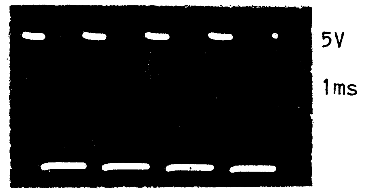


Figure C

While the program is running, check for pulses at pins 14 and 21 of IC U5. If pulses are missing at pin 14, check the Decoder IC (U14). If pulses are missing at pin 21, check IC's U15 and U16. If pulses are present, check for pulses at pins 11 thru 18 of Transceiver IC U17. If pulses are missing, check IC U17. If pulses are present, check the waveforms at pins 11, 15, and 31 thru 34 of IC U5. If any of the waveforms are missing or not correct, check IC U5. If the waveforms check good, check for pulses at pins 6 and 7 of IC U7. If pulses are missing, check IC U7. If pulses are present, check for pulses at pin 7 of IC U6. If pulses are missing, check IC U6.

For the following checks make a "Serial Loopback Socket", see "Test Plugs", and plug it into Connector P1. Run the above program and check for pulses at pin 13 of IC U3 and pins 10 thru 13 of IC U13. If pulses are missing at IC U3, check IC U3. If pulses are missing at IC U13, check IC U13.

To check the Interrupt Request pin (pin 30) of IC U5, remove the Serial Loopback Socket and type in and run the following program:

```
10 OUT 1020,15:OUT 1017,15
20 OUT 1016,255:GOTO 10
```

While the program is running, check for a logic Low at pin 1 of IC U1 and check for pulses at pins 2 and 3 of IC U1. If the readings are not correct at pins 1 or 2, check IC U5. If the readings are good at pins 1 and 2 and pulses are missing at pin 3, check IC U1.

LOGIC CHART (Continued)

SYSTEM BOARD

PIN NO.	IC U71	IC U72	IC U73	IC U74	PIN NO.	IC U74	PIN NO.	IC U74	PIN NO.	IC U74	IC U75
1	*	P	P	P	21	P	41	P	61	*	P
2	*	P	P	*	22	P	42	P	62	H	P
3	*	P	*	*	23	P	43	P	63	P	P
4	H	L	L	P	24	P	44	P	64	P	P
5	H	P	P	P	25	P	45	P	64	P	P
6	H	P	P	H	26	P	46	P	66	P	P
7	H	P	P	P	27	P	47	P	67	P	P
8	L	L	P	P	28	P	48	P	68	P	L
9	P	L	P	L	29	L	49	P			L
10	P	L	L	P	30	H	40	P			L
11	P	P	P	P	31	P	51	P			L
12	H	H	P	P	32	P	52	L			L
13	P	P	P	P	33	P	53	H			P
14	P	P	P	P	34	P	54	H			P
15	P	L	P	P	35	L	55	*			P
16	H	P	P	P	36	P	56	*			P
17		P	L	P	37	P	57	P			P
18		P	H	P	38	P	58	*			P
19		L	P	P	39	P	59	L			L
20		H	H	P	40	P	60	L			H

PIN NO.	IC U77	IC U78	IC U79	IC U80	IC U81	IC U82	IC U83	IC U84	IC U85	IC U86	IC U87	IC U88	IC U89	IC U90
1	H	*	H	L	P	P	P	H	P	H	P	P	H	H
2	H	P	H	L	P	H	P	P	H	P	P	H	P	P
3	P	P	P	L	H	L	P	P	H	P	H	H	P	P
4	H	P	H	P	L	P	P	P	H	P	P	H	P	H
5	H	P	L	P	P	*	P	P	H	P	P	P	P	P
6	L	P	P	P	P	L	P	P	L	P	H	P	*	P
7	L	L	L	L	L	P	P	L	L	L	H	P	*	L
8	P	L	P	H	P	P	P	P	P	L	H	L	H	H
9	P	*	P	P	P	L	P	L	P	H	P	P	P	L
10	H	*	P	H	P	P	L	L	P	H	L	H	L	
11	P	*	P	P	P	H	P	P	P	P	P	H	P	P
12	H	*	P	P	P	L	H	L	P	P	P	H	H	L
13	P	*	P	L	P	P	P	P	P	H	H	P	H	P
14	H	H	H	H	H	*	H	H	H	H	H	H	H	H
15						P	H				P	H	P	
16						P	P				P	H	P	
17						L	P				P		P	
18						H	P				P		P	
19							P				H		L	
20							H				H		H	

LOGIC CHART (Continued)

SYSTEM BOARD

PIN NO.	IC U47	PIN NO.	IC U47	IC U48	IC U49	IC U50	IC U51	IC U52	IC U53	IC U54	IC U55	IC U56	IC U57	IC U58
1	P	21	P	H	P	L	H	H	P	P	P	P	P	P
2	P	22	P	P	P	P	P	*	P	P	P	P	P	P
3	P	23	P	P	P	P	P	L	P	P	P	P	P	P
4	P	24	P	P	L	P	H	L	P	P	P	P	P	P
5	P	25	P	P	P	P	P	H	P	P	P	P	P	P
6	P	26	P	P	L	P	P	H	P	P	P	P	P	P
7	P	27	P	P	P	P	L	L	L	P	P	P	L	L
8	P	28	H	P	P	P	P	H	H	L	L	P	H	H
9	P			P	H	P	P		L	P	P	P	L	P
10	P			L	L	L	H		P	P	P	L	P	L
11	P			P	*	P	P		P	P	P	P	P	P
12	P			P	P	P	H		P	P	P	P	P	H
13	P			P	P	P	P		P	P	P	P	P	L
14	L			P	L	P	H		H	P	P	P	H	H
15	P			P	P	P				L	L	P		
16	P			P	L	P				H	H	P		
17	P			P	P	P						P		
18	P			P	P	P						P		
19	P			L	L	L						P		
20	P			H	H	H						H		

PIN NO.	IC U59	IC U60	IC U61	IC U62	IC U63	IC U64	IC U65	IC U66	IC U67	PIN NO.	IC U67	IC U68	IC U69	IC U70
1	P	P	P	L	H	L	H	P	L	21	P	P	P	H
2	P	P	*	P	P	P	*	P	L	22	P	H	P	H
3	P	P	*	P	*	P	P	P	P	23	L	P	H	P
4	P	P	P	P	P	P	P	P	P	24	H	H	P	L
5	P	P	*	P	H	P	P	P	P			P	P	P
6	P	P	P	P	P	L	P	P	P			P	P	L
7	L	P	L	L	L	H	L	P	P			L	L	L
8	P	P	P	P	P	L	P	P	P			P	P	H
9	P	P	*	P	P	P	P	P	P			P	P	H
10	P	L	P	P	H	L	L	L	P			H	H	H
11	L	P	*	*	*	P	P	P	P			P	P	H
12	L	P	P	*	H	P	P	P	L			P	H	H
13	P	P	*	H	H	L	L	P	P			P	H	H
14	H	P	H	H	H	H	P	P	P			H	H	H
15		P				L	P	P	P					
16		P				P	P	P	P					
17		P				P	P	P	P					
18		P				P	H	P	P					
19		P				P	L	P	P					
20		H				H	H	H	P					

TROUBLESHOOTING (Continued)

POWER SUPPLY

NOTE: Use an isolation transformer with a voltage step down control when servicing the Power Supply. Disconnect Power Supply from Computer and Disk Drives to avoid possible damage from high voltages that may be produced while servicing power supply.

A load must be connected to the Power Supply when it is being operated by itself. Three #1129 lamps may be used as a load for the 5V source and a #93 lamp may be used for the 12V source.

The power supply has an automatic shutdown feature. It will shut down whenever a no-load, over-current, or over-voltage condition exists. The following voltages change on IC's M1 and M2 when the power supply is turned On with no load:

M1		M2	
Pin 4	9.1V	Pin 14	5.7V
Pin 8	4.3V		
Pin 9	6.2V		
Pin 11	3.9V		
Pin 13	4.1V		
Pin 14	9.1V		

The voltages on IC's M5 and M6 all measure less than .3V.

Power Supply dead. Check for 120V AC from Connector E26 to Connector E27. If 120V AC is missing, check Coils L1A and L2A, On-Off Switch (SW2), and Line Filter T1A. If 120V AC is present, check for 323V at the Collector of Power Amp Transistor (Q3). If 323V is missing, check Resistors R2 thru R5, Electrolytics C1 and C2, Thermister R1, and Bridge Rectifier M4. If 323V is present, check waveforms on the bases of Power Amp Transistors Q3 and Q4.

If the waveforms are missing, check the voltages and components associated with IC's M1 and M2, Amp Transistors (Q1), and Driver Transistor (Q2), and check windings on Transformer T1 for continuity. If the waveforms are present, check voltages and components associated with Transistors Q3 and Q4 and check windings on Transformer T2 for continuity.

No 12.0V at pin 1 of Connector P12. Check Rectifier CR15, Coil L1, Capacitors C13 thru C17, and check the winding on Transformer T2 from pin 7 to pin 8 for continuity.

No 5.0V at pin 2 of Connector P8, Check Rectifiers CR16 and CR17, Coil L2, Capacitors C18 thru C26 and check the windings on Transformer T2 on pins 9 thru 16 for continuity.

No -12.0V at pin 4 of Connector P8, check Rectifier CR19, Capacitor C28, and check the winding on Transformer T2 from pin 5 to pin 6 for continuity.

No -5.0V at pin 3 of Connector P9. Check Rectifier CR18, Capacitor C27, and check the winding on Transformer T2 from pin 3 to pin 4 for continuity.

TEST PLUGS

PARALLEL LOOPBACK PLUG

Use a male 25-pin subminiature "D" Connector (DB-25) and connect the following pins together: pin 1 to pin 13, pin 2 to pin 15, pin 12 to pin 14, pin 10 to pin 16, pin 11 to pin 17.

SERIAL LOOPBACK SOCKET

Use a female subminiature "D" Connector (DB-9) and connect the following pins together: pin 1 to 4 and 6, pin 2 to 3, pin 7 to 8 and 9.

PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
KEYBOARD						
CR1	M60	NTE109	ECG109	SK3090/109	103-Z9001	
M1	7402N	NTE7402	ECG7402	SK7402	HE-443-46	
M2	SH779567					
M3	CD1324N					
M4	MJ338978					
M5	B8507CK					
M6,7	CD1324N					
U1	SH779567					
POWER SUPPLY						
CR1	1N5626	NTE5806	ECG5806	SK3848/5806	212-Z9000	
CR2						
CR3	1N4003	NTE116	ECG116	SK3311	212-76-02	
CR4						
CR5						
CR6						
CR7						
CR8	1N5626	NTE5806	ECG5806	SK3848/5806	212-Z9000	
CR9						
CR10						
CR11						
CR12						
CR13						
CR14						
CR15,6,7	D83-004					
CR18,9	SB840					
CR20						
CR21						
CR22						
CR23						

LOGIC CHART

SYSTEM BOARD

PIN NO.	IC U1	IC U2	IC U5	IC U6	IC U7	IC U8	IC U11	IC U12	IC U13	IC U14	IC U18	IC U19	IC U20	IC U23
1	P	P	P	P	P	P	P	P	P	P	L	P	P	P
2	P	P	P	P	P	P	P	P	P	P	P	P	P	P
3	P	P	P	*	P	P	P	*	P	P	*	P	P	P
4	P	P	P	P	P	P	P	P	P	P	L	P	P	P
5	P	P	P	P	P	P	P	P	P	P	L	P	P	P
6	P	P	P	P	P	P	P	P	P	P	L	P	P	P
7	P	P	P	L	P	P	P	L	P	P	*	P	P	P
8	H	H	P	P	H	H	P	P	H	H	P	H	H	H
9	P	P	P	P	P	P	P	P	P	P	L	P	P	P
10	P	P	L	P	P	P	L	P	P	P	L	P	P	P
11	P	P	P	P	P	P	P	P	P	P	*	P	P	P
12	P	P	P	P	P	P	P	P	P	P	P	P	P	P
13	P	P	P	P	P	P	P	P	P	P	L	P	P	P
14	P	P	P	H	P	P	P	H	P	P	*	P	P	P
15	P	P	P		P	P	P		P	P	L	P	P	P
16	L	L	P		L	L	P		L	L	H	L	L	L
17			P				P				P			
18			P				P				H			
19			P				P							
20			H				H							

PIN NO.	IC U24	IC U27	PIN NO.	IC U27	IC U28	IC U29	IC U32	IC U33	IC U34	IC U38	IC U39	IC U40	IC U43	IC U44
1	P	P	21	P	P	P	P	P	P	H	P	P	P	P
2	P	P	22	P	P	P	P	P	P	P	P	P	P	P
3	P	P	23	P	P	P	P	P	P	P	P	P	P	P
4	P	P	24	P	P	P	P	P	P	P	P	P	P	P
5	P	P	25	P	P	P	P	P	P	P	P	P	P	P
6	P	P	26	P	P	P	P	P	P	P	P	P	P	P
7	P	P	27	P	P	P	P	P	P	P	P	P	P	P
8	H	P	28	H	H	H	L	H	H	P	H	H	H	H
9	P	P			P	P	P	P	P	P	P	P	P	P
10	P	P			P	P	L	P	P	L	P	P	P	P
11	P	P			P	P	P	P	P	P	P	P	P	P
12	P	P			P	P	L	P	P	P	P	P	P	P
13	P	P			P	P	P	P	P	P	P	P	P	P
14	P	L			P	P	P	P	P	P	P	P	P	P
15	P	P			P	P	P	P	P	P	P	P	P	P
16	L	P			L	L	H	L	L	P	L	L	L	L
17		P								P				
18		P								P				
19		P								L				
20		P								H				

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SPEAKER

ITEM No.	TYPE	REPLACEMENT DATA MFGR. PART No.	QUAM PART No.	NOTES
SP1	2" PM, 8 Ohms	8529143	2A05Z8	

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
	CHASSIS		
LED1	LED		Power, Green
LED2	LED		Fixed Disk Drive, Red
SW1	Switch		Security
	KEYBOARD		
LED1	LED		Caps Lock, Green
LED2	LED		Num Lock, Green
LED3	LED		Scroll Lock, Green
	POWER SUPPLY		
FB1	Ferrite Bead		
M3	Opto-Isolator		
M7	Fan		
SW1	Switch		AC Voltage Selector
SW2	Switch		Power
	SYSTEM BOARD		
FB1	Ferrite Bead		
FB2	Ferrite Bead		
SW1	Switch		Monitor Select
Y1	Crystal		14.31818MHz
Y2	Crystal		12MHz
Y3	Crystal		32.768MHz

WIRING DATA

Shielded Hook-up Wire .... Use BELDEN No. 8401 or 8421 (Single-Conductor)
8208 (Two-Conductor)
General-use Unshielded Hook-up Wire ...... Use BELDEN No. 8529 (Solid) Available in 13 Colors
8522 (Stranded) Available in 13 Colors

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
CR24						
CR25						
CR26						
CR27						
CR28						
M1,2	LM339N	NTE834	ECG834	SK3569/834	221-121	
M4	10G4B41					
M5	LM339N	NTE834	ECG834	SK3569/834	221-121	
M6	LM358N	NTE928M	ECG928M	SK3692/928M		
Q1	2222A	NTE123A	ECG123A	SK3444/123A	121-Z9000A	
Q2	2N5682	NTE282	ECG282		921-1090	
Q3,4	C3306(JAPAN)	NTE2308	ECG2308			
SYSTEM BOARD						
CR1,2	1N4148	NTE519	ECG519	SK3100/519	103-131	
Q1	2N3904	NTE123AP	ECG123AP	SK3854/123AP	121-Z9000A	
Q2	2N3906	NTE159	ECG159	SK3466/159	121-Z9003	
U1,2	ZA1250NL					
U3,4						USED IN SOME VERSIONS.
U5	SN74ALS245AN				HE-443-1097	
U6	74F280PC					
U7,8	ZA1250NL					
U9,10						USED IN SOME VERSIONS.
U11	SN74ALS245AN				HE-443-1097	
U12	74F280PC					
U13,4	ZA1250NL					
U15,6						USED IN SOME VERSIONS.
U17						USED IN SOME VERSIONS.
U18	D8284A				HE-443-1011	

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
U19,20	ZA1250NL					
U21,2						USED IN SOME VERSIONS.
U23,4	ZA1250NL					
U25,6						USED IN SOME VERSIONS.
U27	MK38097N-21					
U28,9	ZA1250NL					
U30,1						USED IN SOME VERSIONS.
U32	SN74LS590N					
U33,4	ZA1250NL					
U35,6						USED IN SOME VERSIONS.
U37						USED IN SOME VERSIONS.
U38	SN74ALS245AN				HE-443-1097	
U39,40	ZA1250NL					
U41,2						USED IN SOME VERSIONS
U43,4	ZA1250NL					
U45,6						USED IN SOME VERSIONS.
U47	TMM23256P-5879					
U48	SN74ALS245AN				HE-443-1097	
U49	SN74ALS244AN					
U50	74F241PC					
U51	74F74PC					
U52	SN75477P					
U53	74F10PC					
U54,5	74F158PC					
U56	SN74ALS573N				HE-443-1070	
U57,8	74F10PC					
U59	74F08PC					
U60	SN74ALS573N				HE-443-1070	
U62	SN74S51N	NTE74S51	ECG74S51			
U63	74F20PC					

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

CONTROLS (All wattages 1/2 watt, or less, unless listed)

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
	POWER SUPPLY			
P1		500		
P2		250		

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
	KEYBOARD			
A1	Resistor Network	(1)		
A2	Resistor Network	(1)		
A3	Resistor Network	(1)		
	POWER SUPPLY			
A1	Resistor Network	(2)		
A2	Resistor Network	(2)		
A3	Resistor Network	(2)		
A4	Resistor Network	(2)		
A5	Resistor Network	(2)		
A6	Resistor Network	(2)		
R1	NTC 2.4 Cold			
R2	.65 5% 10W WW			
R3	1.3 5% 7W WW			
R6	16K 5% 10W WW			
R11	10K 5% 12.5W WW			
R15	50K 5% 5W Metal Film			
R16	.5 5% 5W WW			
R18	7.5 5% 5W WW			
R20	649 1% 1/8W Carbon Film			
R24	133K 1% 1/8W Carbon Film			
R25	301K 1% 1/8W Carbon Film			
R26	301K 1% 1/8W Carbon Film			
R28	100K 1% 1/8W Carbon Film			
R29	160 5% 3W Metal Film		3W116	
R99	PTC 91.4 Cold		FR605	
	SERIES/PARALLEL BOARD			
RN1	Resistor Network	(7)		
U2	Resistor Network	(5)		
U19	Resistor Network	(6)		
	SYSTEM BOARD			
RN1	Resistor Network	(3)		
RN2	Resistor Network	(3)		
RN3	Resistor Network	(3)		
RN4	Resistor Network	(4)		
RN5	Resistor Network	(4)		

(1) 4000 x 7
(2) No internal information available
(3) 30 ohm x 8 resistor
(4) 10K ohm x 13 resistor

(5) 4700 2% x 5
(6) 27 2% x 8
(7) 4700 x 4

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	MFGR. PART No.
	KEYBOARD	
C1	56 6V 10%	
C2	56 6V 10%	
C4	22 15V 10%	
C11	56 6V 10%	
	SERIES/PARALLEL BOARD	
C11	10 16V 10% (1)	
C12	10 16V 10% (1)	
C21	10 16V 10% (1)	
	SYSTEM BOARD	
C1	10 16V 10% (1)	
C2	10 16V 10% (1)	
C3	10 16V 10% (1)	
C4	10 16V 10% (1)	
C6	10 16V 10% (1)	

ITEM No.	RATING	MFGR. PART No.
C15	10 16V 10% (1)	
C27	10 16V 10% (1)	
C37	10 16V 10% (1)	
C46	10 16V 10% (1)	
C52	10 16V 10% (1)	
C53	10 16V 10% (1)	
C54	10 16V 10% (1)	
C55	10 16V 10% (1)	
C56	10 16V 10% (1)	
C60	10 16V 10% (1)	
C62	10 16V 10% (1)	
C63	10 16V 10% (1)	
C68	10 16V 10% (1)	
C75	10 16V 10% (1)	
C79	10 16V 10% (1)	
C84	10 16V 10% (1)	
C89	10 16V 10% (1)	
C90	10 16V 10% (1)	
C92	10 16V 10% (1)	
C95	10 16V 10% (1)	

Items Not Listed Are Normally Available At Local Distributors.

(1) Two outside legs are ground.

CAPACITORS

ITEM No.	RATING	MFGR. PART No.
	SYSTEM BOARD	
C26	5 - 50pF Trimmer	

ITEM No.	RATING	MFGR. PART No.

COILS & TRANSFORMERS

ITEM No.	FUNCTION	MFGR. PART No.	OTHER IDENTIFICATION	NOTES
	POWER SUPPLY			
L1	RF Choke			
L1A	Filter			
L2	RF Choke			
L2A	Filter			
T1	Switching			
T1A	AC Line Filter			
T2	Power			

COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.
	KEYBOARD	
L1	Filter	

ITEM No.	FUNCTION	MFGR. PART No.

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
U64	SN74ALS573N				HE-443-1070	
U65,6	SN74ALS245AN				HE-443-1097	
U67	SN74LS646NT					
U68	SN74ALS74AN				HE-443-1051	
U69	SN74LS51N	NTE74LS51	ECG74LS51	SK74LS51		
U70	74F11PC					
U71	74F139PC					
U72	TBP28S42N					
U73	SN74ALS573N				HE-443-1070	
U74	CG80286-6C					
U75	SN74ALS244AN					
U77	74F74PC					
U78	SN74S51N	NTE74S51	ECG74S51			
U79	SN74LS125AN	NTE74LS125A	ECG74LS125A	SK74LS125A	HE-443-811	
U80	SN74ALS32N				HE-443-1072	
U81	SN74ALS04AN				HE-443-1082	
U82	D82284-6					
U83	D82288-6					
U84	SN74ALS27N				HE-443-1230	
U85	SN74LS51N	NTE74LS51	ECG74LS51	SK74LS51		
U86	74F74PC					
U87	1501824					
U88	SN74LS112AN	NTE74LS112A	ECG74LS112A			
U89	SN74LS245N	NTE74LS245	ECG74LS245	SK74LS245	HE-443-885	
U90	SN74ALS74AN				HE-443-1051	
U91	SN74ALS02N				HE-443-1045	
U92	74F08PC					
U93	74F74PC					
U94	SN74ALS00AN				HE-443-1080	
U95	74F175PC					

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

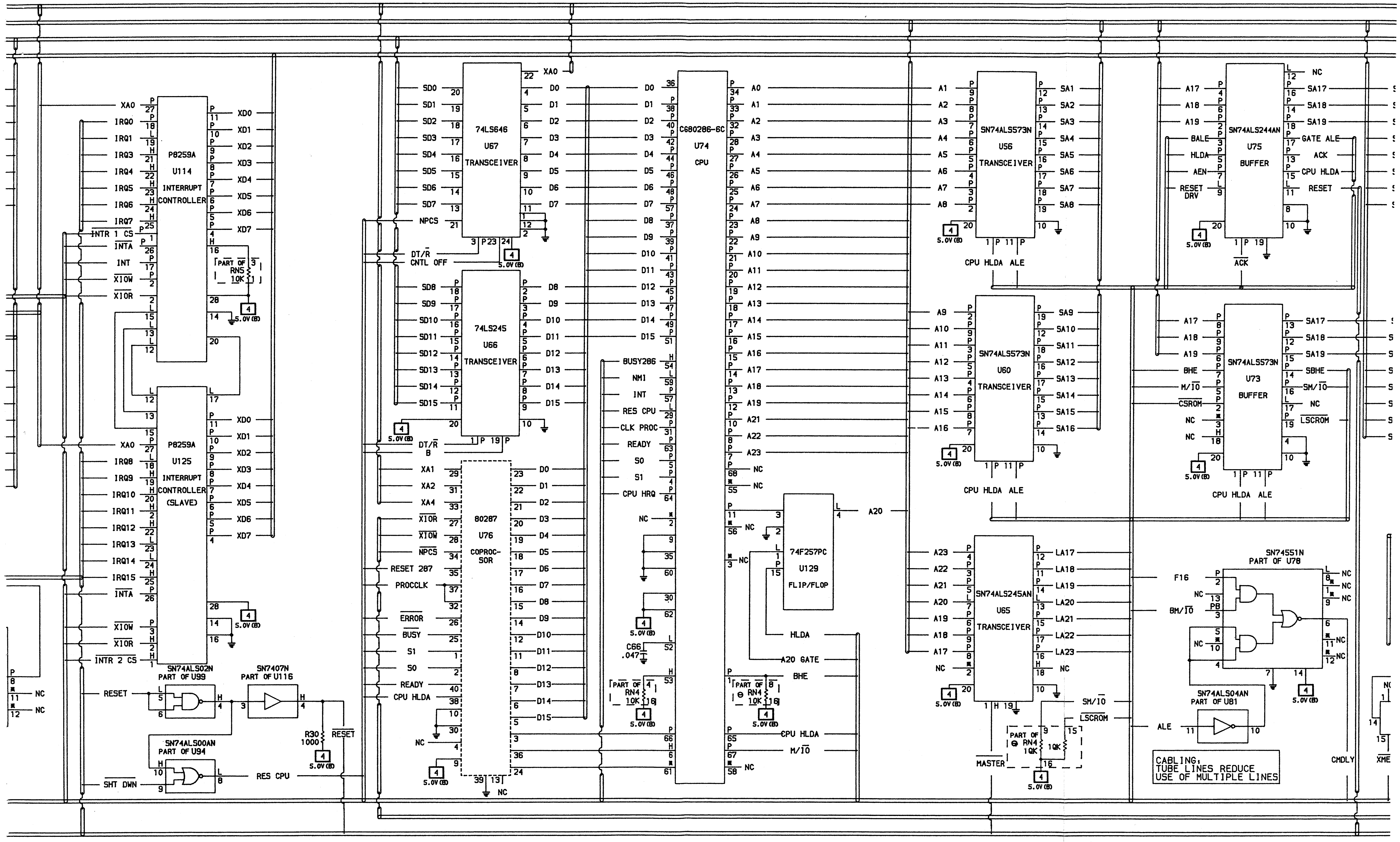
ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
U96	74F00PC					
U97	74F10PC					
U98	SN74ALS10AN				HE-443-1047	
U99	SN74ALS02N				HE-443-1045	
U100	74F175PC					
U101	SN74ALS573N				HE-443-1070	
U102	SN74ALS245AN				HE-443-1097	
U103	P8254-2					
U104,5,6	SN74ALS74AN				HE-443-1051	
U107	SN74ALS04AN				HE-443-1082	
U108	MC14069U	NTE4069	ECG4069	SK4069UB	905-260	
U109	SN74ALS74AN				HE-443-1051	
U110	SN74ALS08N				HE-443-1073	
U111	AM9517A-5PC				HE-443-1170	
U112	SN74ALS573N				HE-443-1070	
U113	SN74ALS245AN				HE-443-1097	
U114	P8259A				HE-443-1012	
U115	63S081N					
U116	SN7407N	NTE7407	ECG7407	SK7407	HE-443-1020	
U117	MC146818P					
U118	SN74ALS74AN				HE-443-1051	
U119	74F174PC					
U120	SN74ALS00AN				HE-443-1080	
U121	SN74ALS04AN				HE-443-1082	
U122	AM9517A-5PC				HE-443-1170	
U123	SN74ALS138N					
U124	SN74LS612N					
U125	P8259A				HE-443-1012	
U126	P86421505					
U127	SN74ALS175N					
U128	SN74ALS244AN					
U129	74F257PC					
U130	1503135					

PARTS LIST AND DESCRIPTION (Continued)

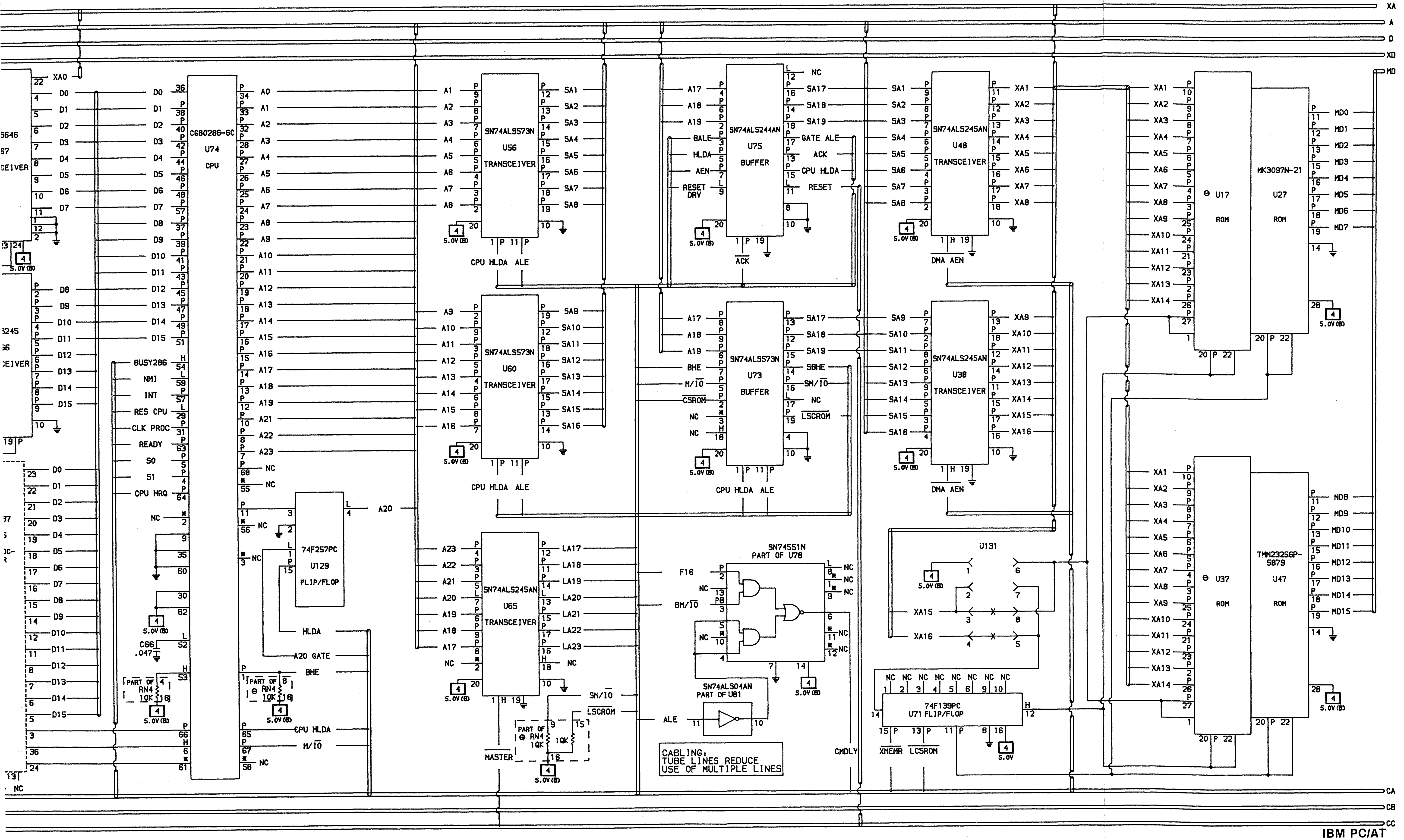
When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
SERIAL/PARALLEL BOARD						
U1	SN74LS125AN	NTE74LS125A	ECG74LS125A	SK74LS125A	HE-443-811	
U3	SN75154N					
U4	SN74LS174N	NTE74LS174	ECG74LS174	SK74LS174	HE-443-879	
U5	NS16450N					
U6,7	SN75150P					
U8	SN74LS240N	NTE74LS240	ECG74LS240	SK74LS240	HE-443-754	
U9	SN74LS244N	NTE74LS244	ECG74LS244	SK74LS244	HE-443-791	
U11	SN7405N	NTE7405	ECG7405	SK7405	HE-443-642	
U12	SN74LS155AN	NTE74LS155	ECG74LS155	SK74LS155	HE-443-782	
U13	SN75154N					
U14	1503085					
U15,6	SN74LS04N	NTE74LS04	ECG74LS04	SK74LS04	HE-443-755	
U17	SN74LS245N	NTE74LS245	ECG74LS245	SK74LS245	HE-443-885	
U18	SN74LS374N	NTE74LS374	ECG74LS374	SK7CT374	HE-443-863	

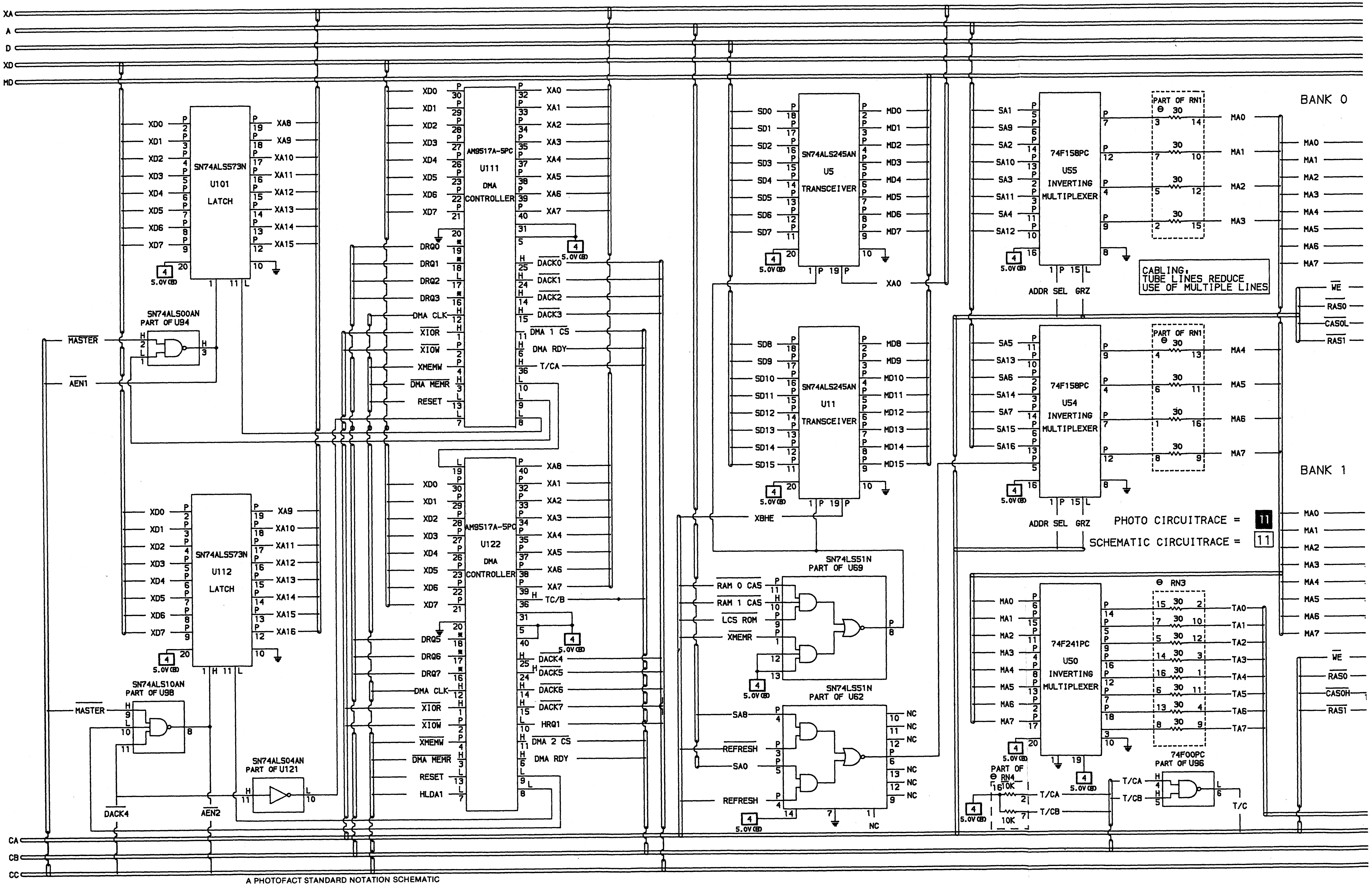

P8259A
U114
INTERRUPT CONTROLLER
P8259A
U125
INTERRUPT CONTROLLER (SLAVE)
XA0
IRQ0
IRQ1
IRQ3
IRQ4
IRQ5
IRQ6
IRQ7
INTR 1 CS
INTA
INT
XIOW
XIOR
IRQ8
IRQ9
IRQ10
IRQ11
IRQ12
IRQ13
IRQ14
IRQ15
INTR 2 CS
XD0
XD1
XD2
XD3
XD4
XD5
XD6
XD7
PART OF RN5 10K
5.0V(B)
SN74ALS02N PART OF U99
SN7407N PART OF U116
SN74ALS00AN PART OF U94
RESET
SHT DWN
RES CPU
R30 1000
74LS646
U67
TRANSCEIVER
74LS245
U66
TRANSCEIVER
SD0
SD1
SD2
SD3
SD4
SD5
SD6
SD7
NPCS
DT/R
CNTL OFF
SD8
SD9
SD10
SD11
SD12
SD13
SD14
SD15
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
80287
U76
COPROCESSOR
XA1
XA2
XA4
XIOR
XIOW
NPCS
RESET 287
PROCCLK
ERROR
BUSY
S1
S0
READY
CPU HLDA
NC
C680286-6C
U74
CPU
BUSY286
NMI
INT
RES CPU
CLK PROC
READY
S0
S1
CPU HRQ
C66 .047
PART OF RN4 10K
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
A19
A21
A22
A23
A20
74F257PC
U129
FLIP/FLOP
HLDA
A20 GATE
BHE
CPU HLDA
M/IO
SN74ALS573N
U56
TRANSCEIVER
SN74ALS573N
U60
TRANSCEIVER
SN74ALS245AN
U65
TRANSCEIVER
SA1
SA2
SA3
SA4
SA5
SA6
SA7
SA8
SA9
SA10
SA11
SA12
SA13
SA14
SA15
SA16
LA17
LA18
LA19
LA20
LA21
LA22
LA23
CPU HLDA ALE
MASTER
SM/IO
LSCROM
PART OF RN4 10K
SN74ALS244AN
U75
BUFFER
SN74ALS573N
U73
BUFFER
BALE
HLDA
AEN
RESET DRV
ACK
GATE ALE
CPU HLDA
SA17
SA18
SA19
SBHE
SM/IO
CSROM
LSCROM
SN74551N PART OF U78
F16
8M/IO
SN74ALS04AN PART OF U81
ALE
CMDLY
XME

CABLING;
TUBE LINES REDUCE
USE OF MULTIPLE LINES


XA
A
D
XD
MD
CA
CB
CC
C680286-6C
U74
CPU
BUSY286
NMI
INT
RES CPU
CLK PROC
READY
S0
S1
CPU HRQ
C66
.047
PART OF RN4
10K
5.0V(B)
74F257PC
U129
FLIP/FLOP
A20
HLDA
A20 GATE
BHE
CPU HLDA
M/IO
SN74ALS573N
U56
TRANSCEIVER
SN74ALS573N
U60
TRANSCEIVER
SN74ALS245AN
U65
TRANSCEIVER
MASTER
SM/IO
LSCROM
SN74ALS244AN
U75
BUFFER
BALE
HLDA
AEN
RESET DRV
GATE ALE
ACK
RESET
SN74ALS573N
U73
BUFFER
CSROM
SBHE
SN74S51N
PART OF U78
F16
BM/IO
SN74ALS04AN
PART OF U81
ALE
CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES
CMDLY
SN74ALS245AN
U48
TRANSCEIVER
DMA AEN
SN74ALS245AN
U38
TRANSCEIVER
U131
XA15
XA16
74F139PC
U71 FLIP/FLOP
XMEMR
LCSROM
U17
ROM
MK3097N-21
U27
ROM
U37
ROM
TMM23256P-5879
U47
ROM
MD0
MD1
MD2
MD3
MD4
MD5
MD6
MD7
MD8
MD9
MD10
MD11
MD12
MD13
MD14
MD15

SYSTEM BOARD

IBM PC/AT
MODEL 5170-239


XA
A
D
XD
MD
CA
CB
CC
SN74ALS573N
U101
LATCH
SN74ALS573N
U112
LATCH
SN74ALS00AN
PART OF U94
SN74ALS10AN
PART OF U98
SN74ALS04AN
PART OF U121
MASTER
AEN1
DACK4
AEN2
AM9517A-5PC
U111
DMA
CONTROLLER
AM9517A-5PC
U122
DMA
CONTROLLER
DRQ0
DRQ1
DRQ2
DRQ3
DRQ5
DRQ6
DRQ7
DMA CLK
XIOR
XIOW
XMEMW
DMA MEMR
RESET
HLDA1
DACK0
DACK1
DACK2
DACK3
DACK4
DACK5
DACK6
DACK7
DMA 1 CS
DMA 2 CS
DMA RDY
T/CA
TC/B
HRQ1
5.0V
SN74ALS245AN
U5
TRANSCEIVER
SN74ALS245AN
U11
TRANSCEIVER
XBHE
SN74LS51N
PART OF U69
SN74LS51N
PART OF U62
RAM 0 CAS
RAM 1 CAS
LCS ROM
XMEMR
SA8
REFRESH
SA0
NC
74F158PC
U55
INVERTING
MULTIPLEXER
74F158PC
U54
INVERTING
MULTIPLEXER
74F241PC
U50
INVERTING
MULTIPLEXER
ADDR SEL
GRZ
PART OF RN1
RN3
PART OF RN4
10K
74F00PC
PART OF U96
T/CA
T/CB
T/C
BANK 0
BANK 1
WE
RAS0
CASOL
CASOH
RAS1
CABLING,
TUBE LINES REDUCE
USE OF MULTIPLE LINES
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11

A PHOTOFACT STANDARD NOTATION SCHEMATIC

WITH CIRCUITRACE

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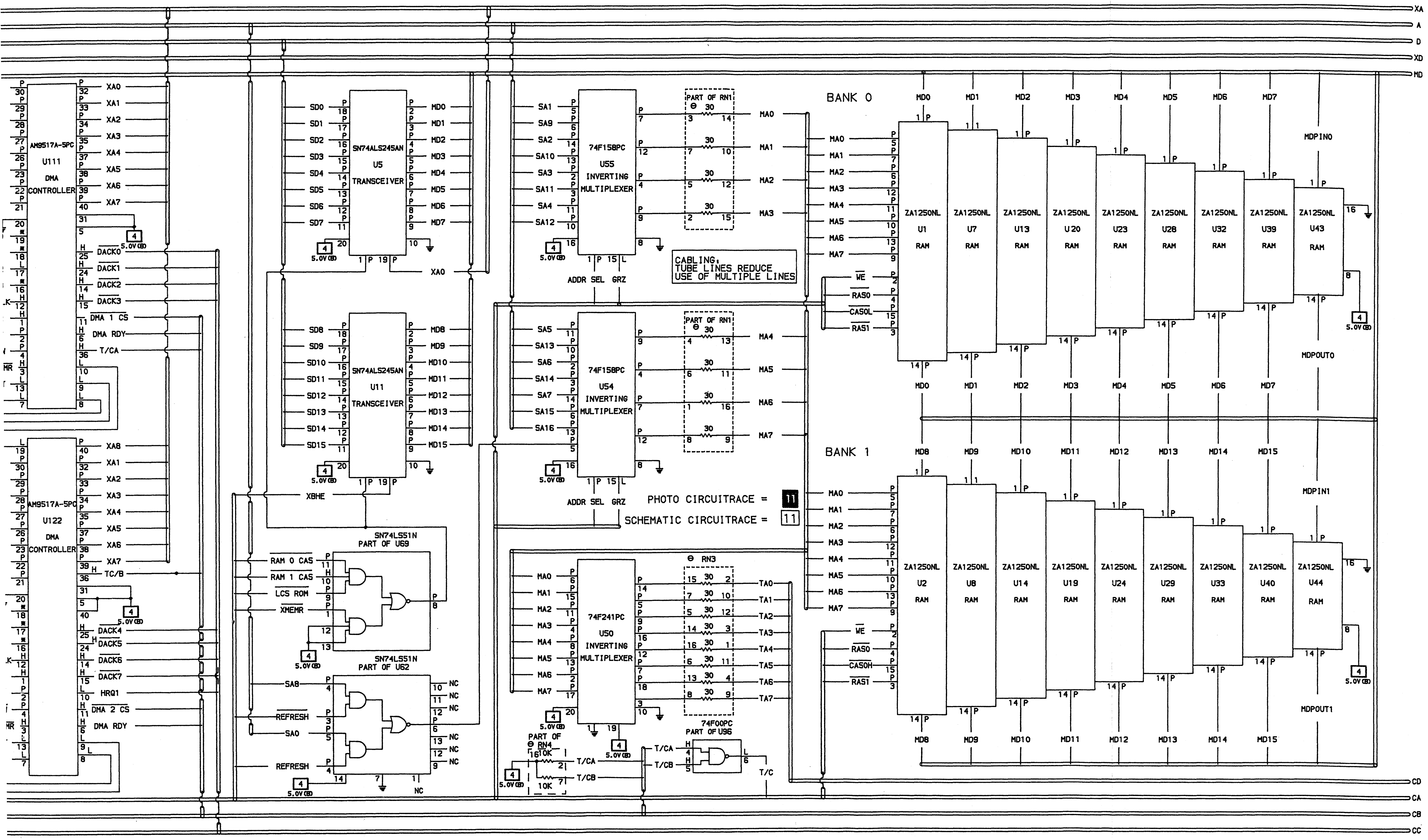
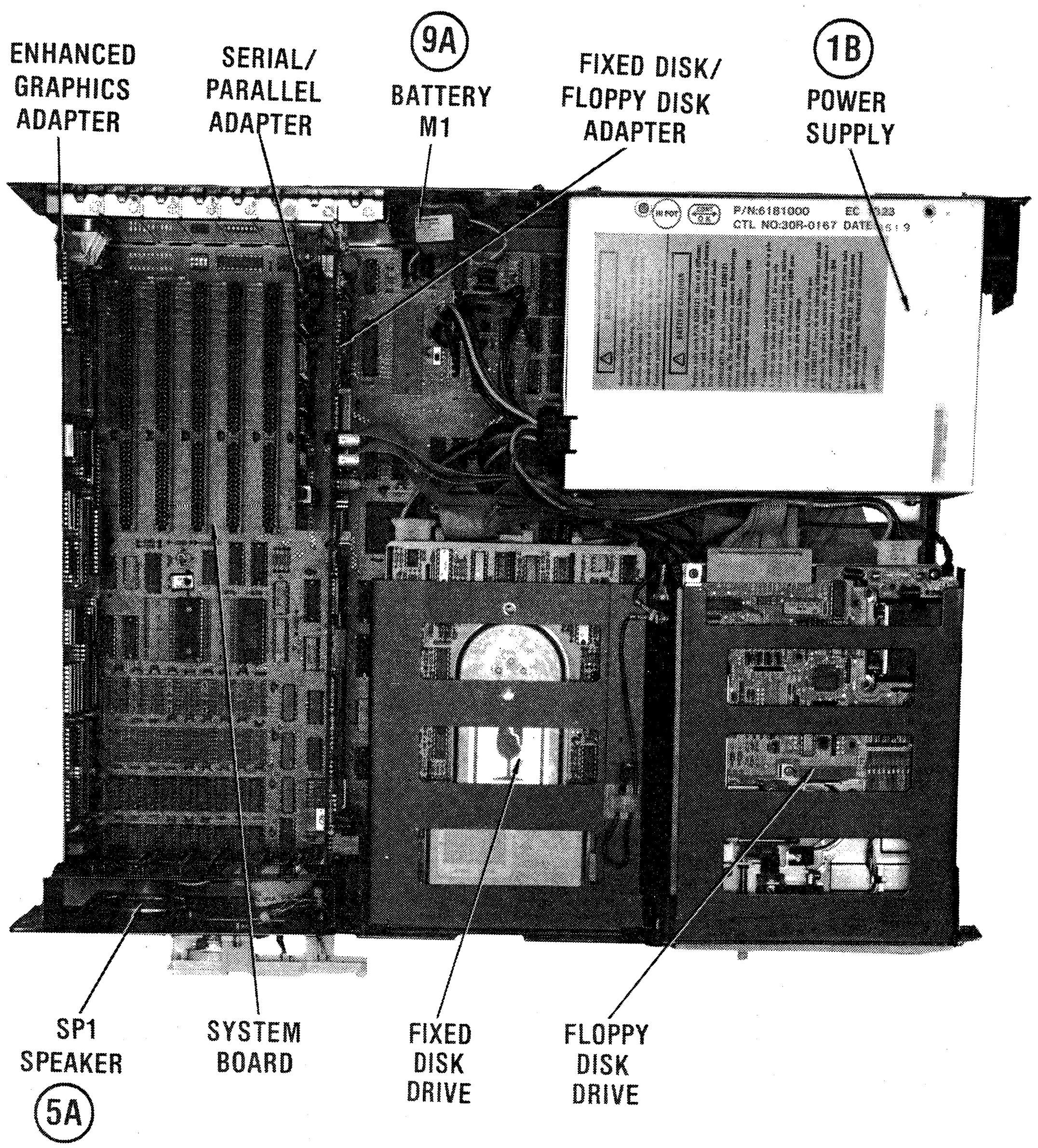
SYSTEM BOARD



XA
A
D
XD
MD
CD
CA
CB
CC
AM9517A-5PC
U111
DMA CONTROLLER
XA0
XA1
XA2
XA3
XA4
XA5
XA6
XA7
5.0V
DACK0
DACK1
DACK2
DACK3
DMA 1 CS
DMA RDY
T/CA
AM9517A-5PC
U122
DMA CONTROLLER
XA8
TC/B
DACK4
DACK5
DACK6
DACK7
HRQ1
DMA 2 CS
DMA RDY
SN74ALS245AN
U5
TRANSCEIVER
SD0
SD1
SD2
SD3
SD4
SD5
SD6
SD7
MD0
MD1
MD2
MD3
MD4
MD5
MD6
MD7
SN74ALS245AN
U11
TRANSCEIVER
SD8
SD9
SD10
SD11
SD12
SD13
SD14
SD15
MD8
MD9
MD10
MD11
MD12
MD13
MD14
MD15
XBHE
SN74LS51N
PART OF U69
RAM 0 CAS
RAM 1 CAS
LCS ROM
XMEMR
SN74LS51N
PART OF U62
SA8
REFRESH
SA0
REFRESH
NC
74F158PC
U55
INVERTING MULTIPLEXER
SA1
SA9
SA2
SA10
SA3
SA11
SA4
SA12
ADDR SEL
GRZ
PART OF RN1
30
MA0
MA1
MA2
MA3
74F158PC
U54
INVERTING MULTIPLEXER
SA5
SA13
SA6
SA14
SA7
SA15
SA16
MA4
MA5
MA6
MA7
CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
74F241PC
U50
INVERTING MULTIPLEXER
RN3
TA0
TA1
TA2
TA3
TA4
TA5
TA6
TA7
PART OF RN4
10K
T/CA
T/CB
74F00PC
PART OF U96
T/C
BANK 0
WE
RAS0
CASOL
RAS1
ZA1250NL
U1
U7
U13
U20
U23
U28
U32
U39
U43
RAM
MDPIN0
MDPOUT0
BANK 1
CASOH
U2
U8
U14
U19
U24
U29
U33
U40
U44
MDPIN1
MDPOUT1

⑥C

B



CSCS17
IBM PC/AT
MODEL 5170-239

PRELIMINARY SERVICE CHECKS

This data provides the user with a time-saving service tool which is designed for quick isolation and repair of Printer malfunctions.

Check all interconnecting cables for good connection and correct hookup before making service checks.

Always turn the computer Off before connecting or disconnecting connectors, boards, or peripherals.

Disconnect all external peripherals from the Computer system to eliminate possible external malfunctions.

Replacement or repair of the Power Supply, System Board, Keyboard, Enhanced Graphics Adapter, Serial/Parallel Adapter, Fixed-Disk-Floppy Diskette Adapter, Disk Drives or connectors may be necessary after the malfunction has been isolated.

TEST EQUIPMENT AND TOOLS

TEST EQUIPMENT

Digital Volt/Ohm Meter
Logic Probe
Frequency Counter
Disk Drive Tester or Test Program

TOOLS

Head Cleaning Equipment
Contact and Switch Cleaner (non-spray type)
Phillips Screwdriver
Flat Blade Screwdriver
1/4" Socket
IC Insertion and Removal Tools 28 pin
Alignment Tools: GC Electronics 5000, 8276, 8089
Low Wattage Soldering Iron
Desoldering Equipment

PARALLEL LOOPBACK PLUG

Use a male 25-pin subminiature "D" Connector (DB-25) and connect the following pins together: pin 1 to pin 13, pin 2 to pin 15, pin 12 to pin 14, pin 10 to pin 16, pin 11 to pin 17.

REPLACEMENT PARTS

Y2	12MHz Crystal
U27	ROM
U47	ROM
SP1	Speaker, 2" PM, 8 ohms
M1	2.6V Lithium Battery

SAMS™ Howard W. Sams & Co.
4300 West 62nd Street, P.O. Box 7092, Indianapolis, Indiana 46206 U.S.A.

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co. as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co. by the manufacturers of the particular type of replacement part listed.

87CS14998 DATE 5-87

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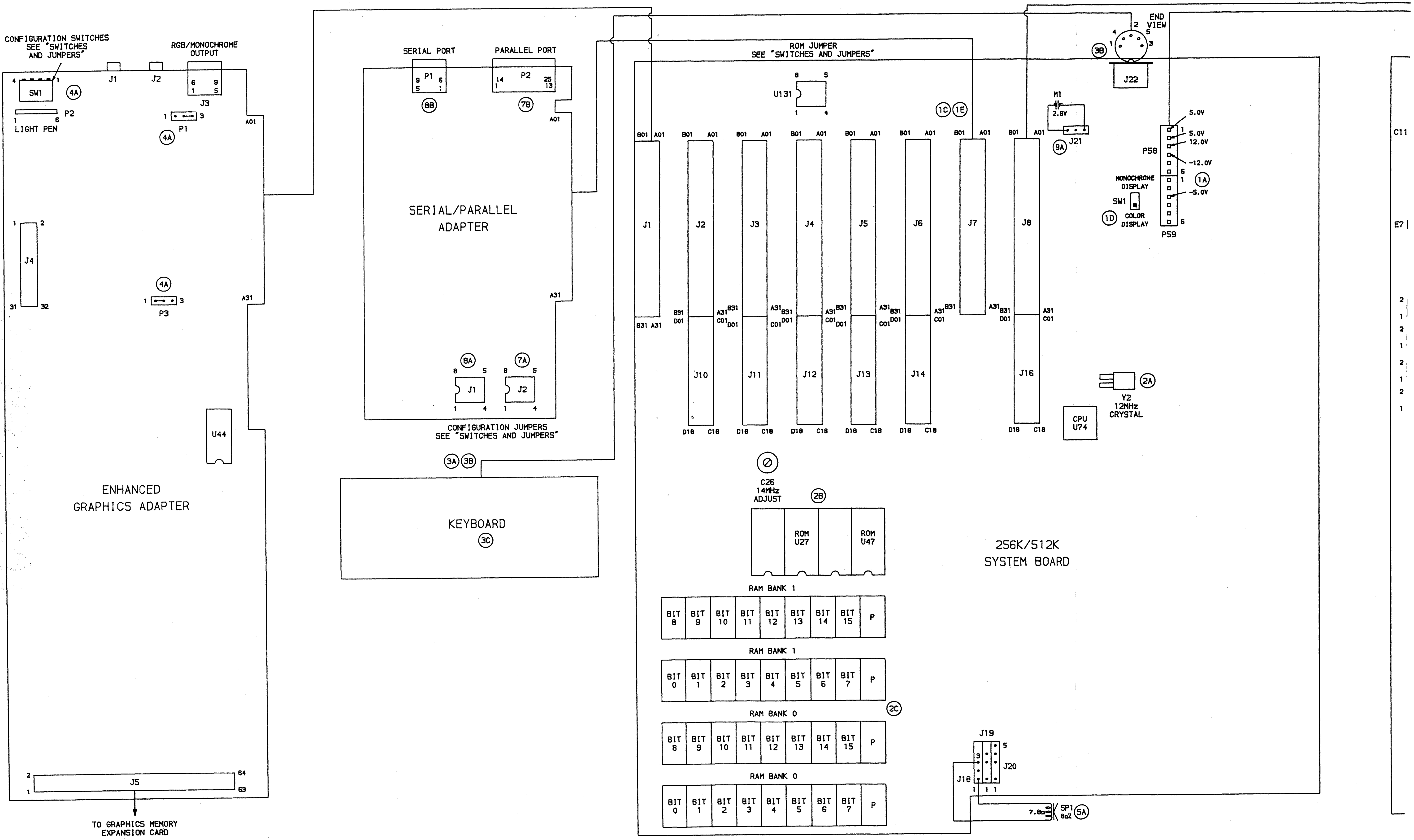
Printed in U.S. of America


CONFIGURATION SWITCHES SEE "SWITCHES AND JUMPERS"
SW1
4A
J1
J2
RGB/MONOCHROME OUTPUT
J3
P2
LIGHT PEN
P1
A01
J4
P3
A31
U44
ENHANCED GRAPHICS ADAPTER
J5
TO GRAPHICS MEMORY EXPANSION CARD
SERIAL PORT
PARALLEL PORT
P1
P2
8B
7B
SERIAL/PARALLEL ADAPTER
8A
7A
J1
J2
CONFIGURATION JUMPERS SEE "SWITCHES AND JUMPERS"
3A
3B
KEYBOARD
3C
ROM JUMPER SEE "SWITCHES AND JUMPERS"
U131
1C
1E
B01
A01
B31
A31
C01
D01
C18
D18
J1
J2
J3
J4
J5
J6
J7
J8
J10
J11
J12
J13
J14
J16
C26 14MHz ADJUST
2B
ROM U27
ROM U47
RAM BANK 1
RAM BANK 0
BIT 0
BIT 1
BIT 2
BIT 3
BIT 4
BIT 5
BIT 6
BIT 7
BIT 8
BIT 9
BIT 10
BIT 11
BIT 12
BIT 13
BIT 14
BIT 15
P
2C
256K/512K SYSTEM BOARD
END VIEW
J22
M1
2.6V
J21
9A
5.0V
12.0V
-12.0V
-5.0V
P58
P59
1A
MONOCHROME DISPLAY
SW1
COLOR DISPLAY
1D
Y2 12MHz CRYSTAL
2A
CPU U74
J19
J20
J18
SP1 8ΩZ
7.8Ω
5A
C11
E7

INTERCONNECTING DIAGRAM

PREVENTATIVE MAINTENANCE

ENVIRONMENT

Computers perform best in a clean, cool area that is below 80 degrees Fahrenheit and free of dust and smoke particles. Even though home Computers are not affected by cigarette smoke as much as commercial Computers are affected, it is better to mantain a smoke-free area around the Computer. Do not block cabinet vents of Computer, Monitor, Printer, or other power devices.

ELECTRICAL POWER

Variations in the line voltage can affect the Computer. Try to avoid these fluctuations by using an AC receptacle that is on a power line not used by appliances or other heavy current demand devices. A power-surge protector, power-line conditioner, or non-interruptable power supply may be needed to cure the problem. **Do not** switch power On and Off frequently.

KEYBOARD

Liquids spilled into the Keyboard can ruin it. Immediately after a spill occurs, disconnect the Computer power plug from AC power outlet. Then, if circuitry or contacts are contaminated, disassemble the Keyboard and carefully rinse the Keyboard printed circuit board with distilled water and let it dry. Use a cotton swab to clean between the keys. Use a non-abrasive contact cleaner and lint-free wipers on accessible connectors and contacts.

DISK DRIVES

Clean the read/write heads of the Disk Drives about once a month or after 100 hours usage. Use only an approved head cleaning kit.

Handle carefully to preserve proper disk head alignment. A sudden bump or jolt to the Disk Drives can knock the disk head out of alignment. If Disk Drive must be transported, place an old disk in slot and close door during transport.

Store disks in their protective covers and never touch the disk surface. Observe the disk handling precautions usually found on the back of disk protective covers.

PRINTERS

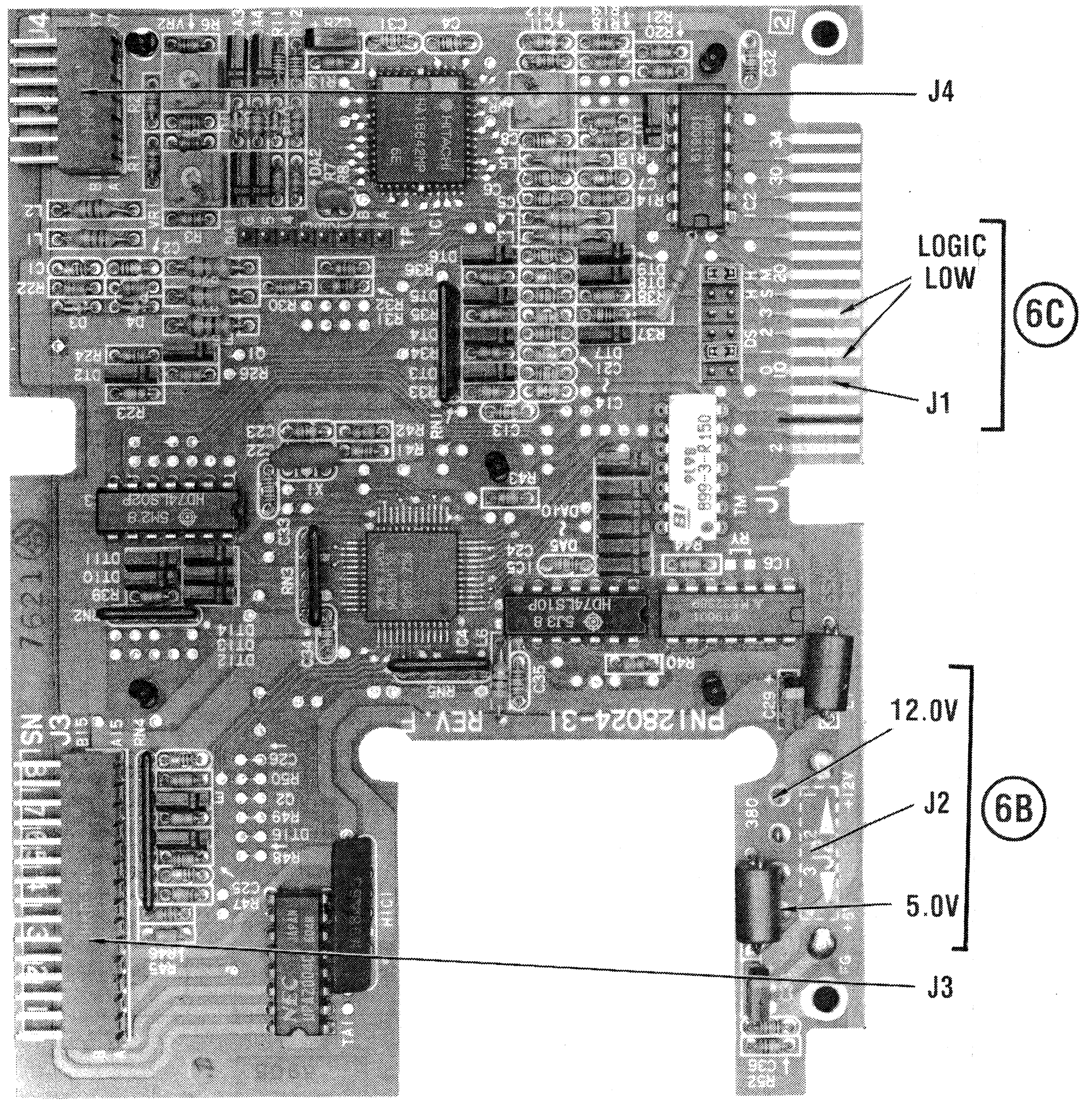
Carefully vacuum the Printer regularly. Wipe surface areas clean using a light all-purpose cleaner. Do not oil the machine. The oil will collect abrasive grit and dust. The dust will act as a blanket. This can cause components to overheat and fail.

STATIC ELECTRICITY

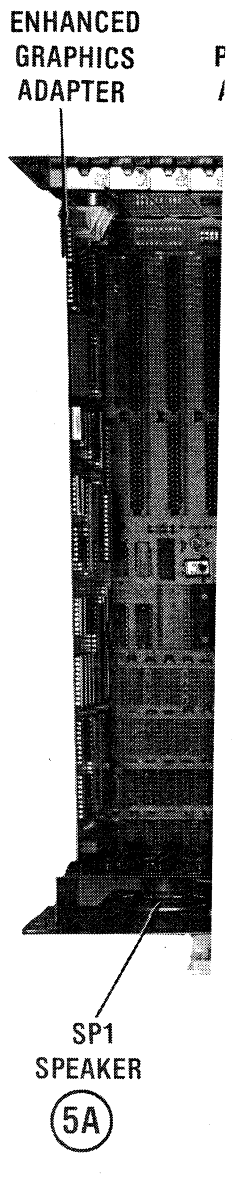
Static electricity discharge can affect the Computer. In order to minimize the possibility, use anti-static mats, sprays, tools and materials, and maintain good humidity in the Computer environment.

MONITOR

Use an isolation transformer with any Monitor that does not come as part of the system since some Monitors use a HOT chassis (chassis connected to one side of the AC line). The face of the Monitor should never be left on for long period of time at high brightness level except when pattern is being changed periodically. Use caution when cleaning anti-glare screens, to preserve the glare-reduction feature.

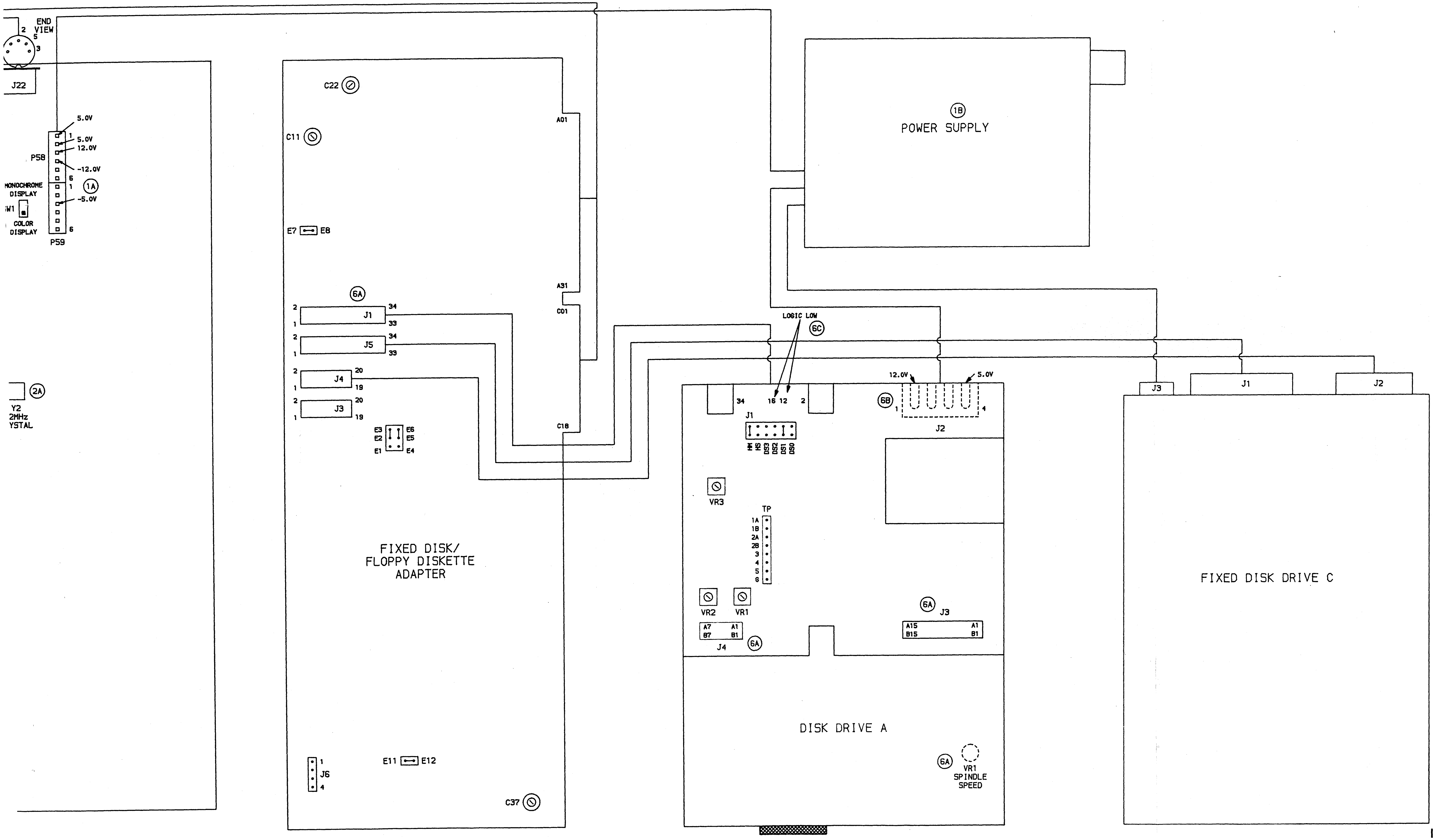


DISK DRIVE BOARD



CHASSIS - OVERALL

NARY SERVICE CHECKS (Continued)

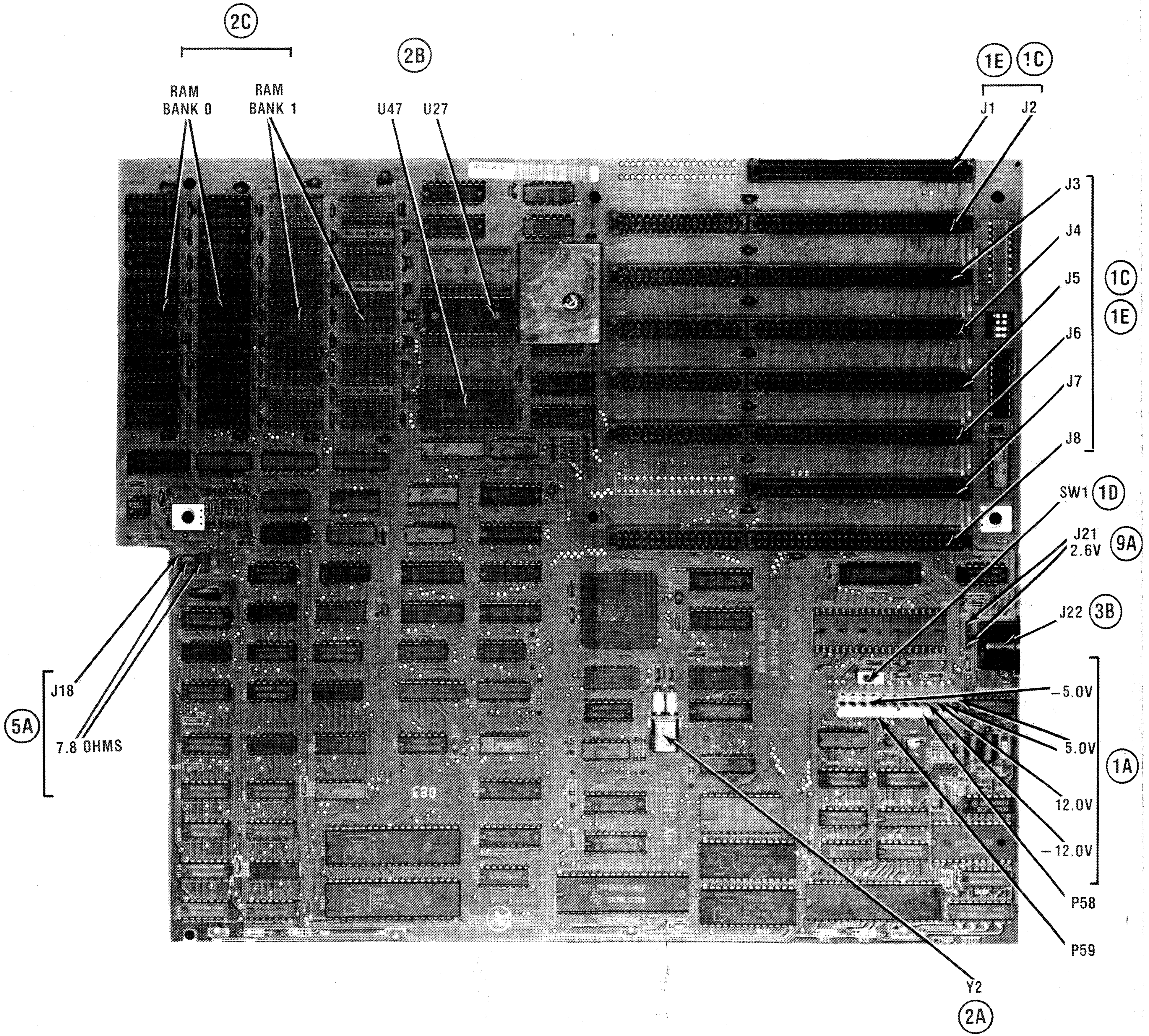


END VIEW
2
5
3
J22
5.0V
5.0V
12.0V
-12.0V
-5.0V
1
6
1
6
P58
P59
1A
MONOCHROME DISPLAY
W1
COLOR DISPLAY
2A
Y2
2MHz
YSTAL
C22
C11
A01
A31
C01
C18
E7
E8
6A
J1
J5
J4
J3
2
1
34
33
20
19
E3
E2
E1
E6
E5
E4
FIXED DISK/
FLOPPY DISKETTE
ADAPTER
J6
1
4
E11
E12
C37
1B
POWER SUPPLY
LOGIC LOW
6C
12.0V
5.0V
6B
J2
34
16 12
2
HM
HS
DS3
DS2
DS1
DS0
VR3
TP
1A
1B
2A
2B
3
4
5
6
VR2
VR1
A7
B7
A1
B1
J4
6A
J3
A15
B15
A1
B1
DISK DRIVE A
6A
VR1
SPINDLE
SPEED
J3
J1
J2
FIXED DISK DRIVE C

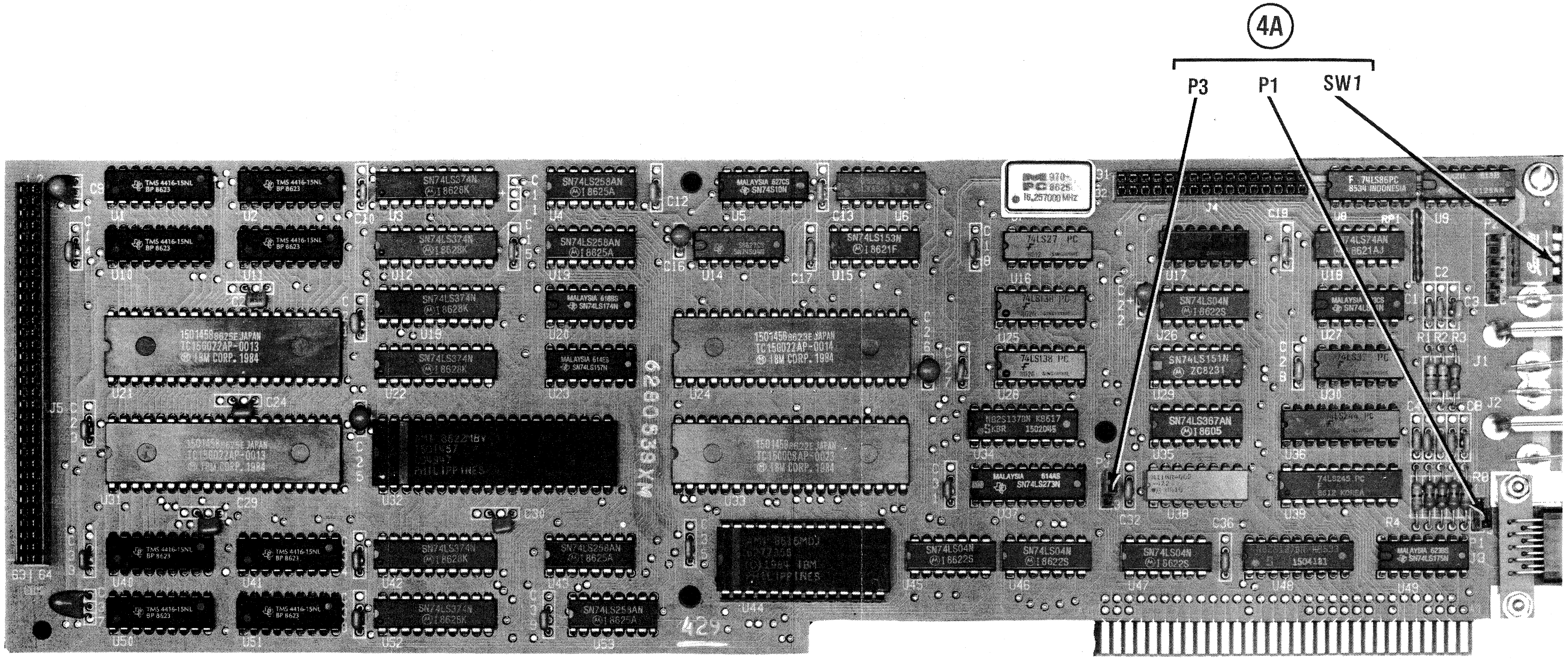
INTERCONNECTING DIAGRAM

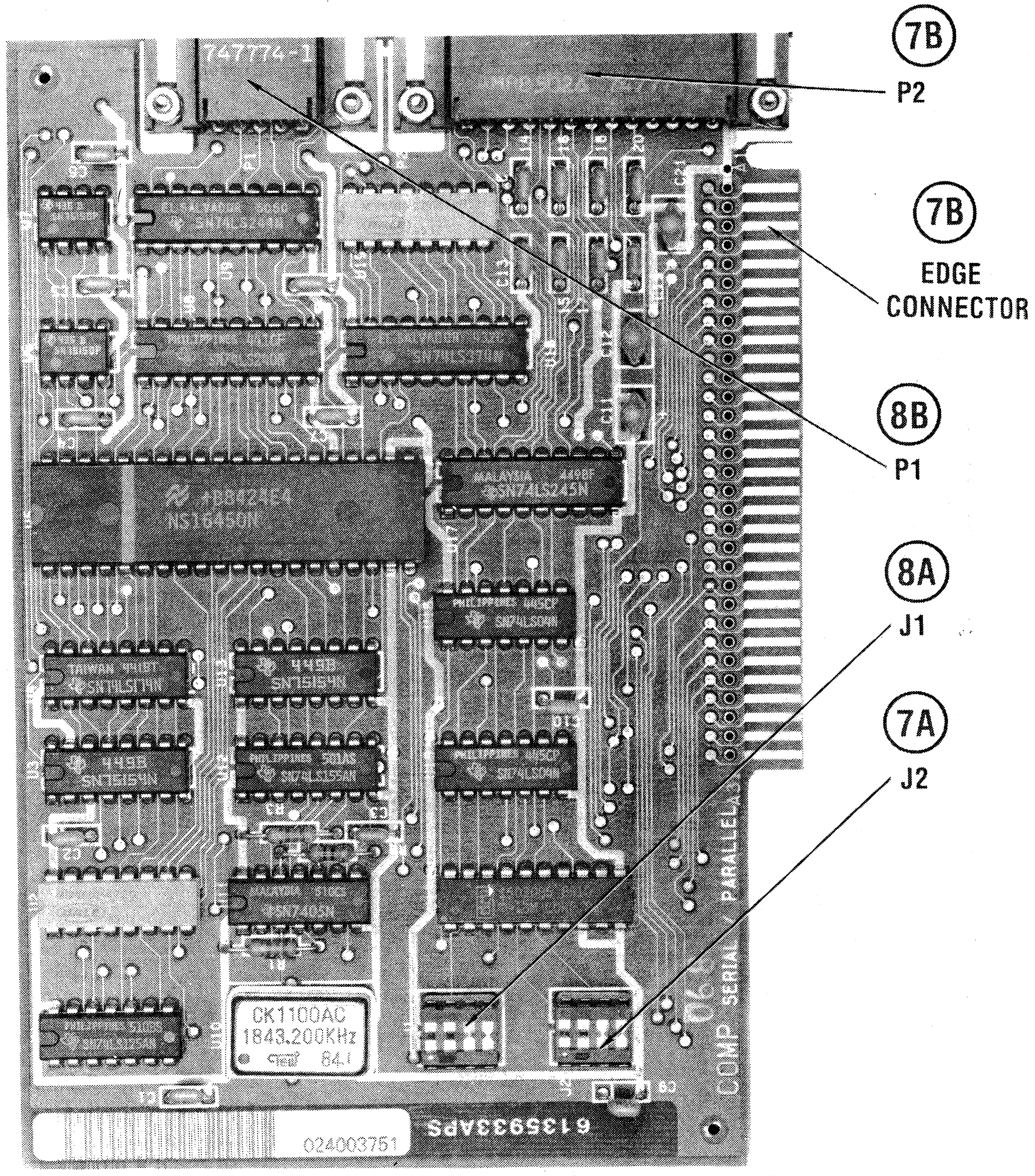
IBM PC/AT
MODEL 5170-

PRELIMINARY SERVICE CHECKS (Continued)


2C
RAM BANK 0
RAM BANK 1
2B
U47
U27
1E
1C
J1
J2
J3
J4
J5
J6
J7
J8
1C
1E
SW1
1D
J21
2.6V
9A
J22
3B
−5.0V
5.0V
12.0V
−12.0V
1A
P58
P59
Y2
2A
J18
7.8 OHMS
5A

PRELIMINARY SERVICE CHECKS (Continued)





GENERAL OPERATING INSTRUCTIONS

POWER ON TEST

A Power On test is automatically performed each time the Computer is turned On. Several diagnostic tests are performed and if a problem is detected, an error code will be displayed on the Monitor screen. For an explanation of the various error codes, see the "Computer Self-Test" section of the General Operating Instructions.

BOOT UP

Insert a bootable diskette into Disk Drive A and turn On the Computer. The Computer will automatically boot up using the diskette in Disk Drive A. If a PC DOS (Personal Computer Disk Operating System) diskette is used, the Computer will display the date and time and ask for a new date and time. After the date and time has been entered, the version of DOS will be displayed on the Monitor screen along with an A> which indicates the DOS is running. If Fixed (Hard) Disk Drive is installed, the Computer will boot up from the Fixed Drive if no diskette is inserted in the Floppy Disk Drive.

PC DOS

For a list of file names on the diskette in the current Disk Drive, type DIR and press the ENTER key. To specify Disk Drive that is not current (default), use DIR A: for Disk Drive A or DIR B: for Disk Drive B. If a Fixed (Hard) Disk Drive is installed, use DIR C:.

To return to PC DOS from Basic, type SYSTEM and press the ENTER key.

To load a (System) program from a diskette while in DOS, type the program name and press the ENTER key.

A blank diskette must be formatted before it can be used to save information which is in memory. A formatted diskette must contain a DOS or a Start-up program before the Computer can boot up using that diskette.

To format a blank diskette, insert a diskette containing a "Format Program" into Disk Drive A. Type FORMAT and press the ENTER key. Follow the instructions on the Monitor screen to format the unformatted diskette. NOTE: Formatting a diskette will wipe out any programs previously placed on the diskette. The Computer automatically defaults to the current Drive if the destination Disk Drive is not specified. Be sure to specify the destination Disk Drive of the diskette to be formatted or programs on the original diskette may be erased by the default action.

BASIC

When turned On, the Computer will come up in ROM Basic if there is not a bootable diskette in Disk Drive A and the Fixed (Hard) Disk Drive is not installed. If a Fixed Disk Drive is installed, the Computer will boot up from the Fixed Disk Drive if no diskette is inserted in the Floppy Disk Drive. If the Fixed Disk Drive does not contain a bootable program the Computer will come up in ROM Basic.

The manufacturer also supplies Disk Basic as well as Advanced Disk Basic on diskette. To load either Disk Basic, first boot up DOS. Insert a diskette with a Disk Basic or an Advanced Disk Basic program on it. Type BASIC and press the RETURN key to load Disk Basic or type BASICA and press the ENTER key to load Advanced Disk Basic. To return to DOS from Basic, type SYSTEM and press the ENTER key.

To view a list and the names of programs on a diskette in the current Drive, type FILES and press the ENTER key. Type FILES "B:" and press the ENTER key to list programs from Disk Drive B. Type FILES "A:" to list programs from Disk Drive A if it is not the current (default) drive. Type FILES "C:" to list programs from the Fixed Disk Drive if it is not the current drive.

To load a program in Disk Basic or Advanced Disk Basic from the diskette, type LOAD, the program name enclosed in quotes, and press the ENTER key. To load a program from a Disk Drive other than the default Drive, add the Drive letter with a colon in front of the program name.

LOAD"B:NAME"

To save a program, type SAVE, the program name enclosed in quotes and press the ENTER key. To save a program to a Disk Drive other than the default Drive, add the Drive letter with a colon in front of the program name.

SAVE"B:NAME"

To run a program from Basic mode, type RUN and press the ENTER key. To stop a program, press the CTRL and BREAK (SCROLL LOCK) keys at the same time. NOTE: Some programs will disable or not recognize the CTRL and BREAK keys to prevent the user stopping the program while it is running.

RESETTING COMPUTER

Press the CTRL, ALT, and DEL keys, all three at the same time, to reset the Computer.

SYSTEM OPTIONS SETUP

Information on the time, date and the options that are installed in the Computer is stored in CMOS RAM IC (U117) that is powered by a Battery (M1) when the Computer is turned Off. If any option is removed or added to the Computer or the Battery (M1) is replaced, a Setup program must be run to put the time, date, and option information in the CMOS RAM. A Setup program is included on the Diagnostic Disk in the "Guide To Operations" manual that comes with the Computer. Insert the Diagnostic Disk in Drive A and turn the Computer On. A menu will come up on the Monitor screen listing the functions available. Select the Set up function (number 4) and follow the instructions on the screen to set the time, date, and options.

PRELIMINARY SERVICE CHECKS (Continued)

MATCH THE NUMBERS ON THE INTERCONNECTING DIAGRAM AND PHOTOS WITH THE NUMBERS ON THE SERVICE CHECKS TO BE PERFORMED.

SERVICE CHECKS

① COMPUTER DEAD

(A) Check for 5.0V at pins 1 and 2, 12.0V at pin 3 and -12.0V at pin 4 of Connector P8 (P58 on System Board) and -5.0V at pin 3 of Connector P9 (P59 on System Board). If the voltages check good, go to part (D).

(B) If the voltages are missing at Connectors P8 and P9, disconnect Connectors P8 thru P12 from the System Board and Disk Drives. Connect three #1129 light bulbs from the 5.0V source (pin 4 of Connector P11) to ground (pin 2 of Connector P11) to provide a load for the Power Supply. Turn Power Supply On and recheck the voltages. If the voltages are still missing, replace or troubleshoot the Power Supply.

(C) If the voltages check good with Connectors P8 thru P12 disconnected, remove all the plug in boards from the System Board I/O Connectors (J1 thru J8) with Computer turned Off. Reconnect the Boards and Disk Drives one at a time and recheck the power supply voltages until the bad board or drive that is causing the Power supply shutdown is found. Warning: Be sure Computer is turned Off when removing or inserting boards.

(D) Check the settings of Switch SW1, see "Switches and Jumpers" for correct settings.

(E) If Switch SW1 is set properly, turn Computer Off and remove all Boards from the System Board slots. One long beep and two short beeps should be heard when Computer is turned back On. If no beeps are heard, go to the "System Board Dead" section of these "Service Checks". If the beeps are heard, plug the Boards back into the System Board (with Computer Off), one at a time, and recheck the operation of the Computer until the bad board is found.

② SYSTEM BOARD

(A) System Board dead. Check for pulses at pin 10 of the Clock Generator IC (U82). If pulses are missing, check the 12MHz Crystal (Y2).

(B) If pulses are present at pin 10 of IC U82, check ROM IC's U27 and U47.

(C) A program runs for a while, then suddenly stops or becomes erratic in operation. Check the RAM IC's in Banks 0 and 1.

③ KEYBOARD DEAD

(A) Check the Keyboard cable for continuity.

(B) Disconnect the Keyboard and check the logic readings at pins 1 and 2 of Keyboard Connector (J22) while turning Computer On. Pin 1 should pulse three times in 15 seconds and pin 2 should pulse once in about 16 seconds after Computer is turned On. If the logic readings are not correct, replace or troubleshoot the System Board. If the readings are correct, replace or troubleshoot the Keyboard.

(C) If one key or group of keys do not work, replace or troubleshoot the Keyboard.

④ ENHANCED GRAPHICS ADAPTER

(A) No video on Monitor screen. Check the settings of Switch SW1 and Jumpers P1 and P3 on the EGA Board. See "Switches and Jumpers".

⑤ INTERNAL SPEAKER

(A) No sound. Check the Speaker Connector (J18 for good connections and check the Speaker Coil (SP1) for continuity (7.8 ohms).

⑥ DISK DRIVE ADAPTER AND DISK DRIVE

WARNING: It is possible for a defective Disk Drive to write on or erase information on a diskette even when the diskette is write protected. Check a questionable Disk Drive by first using a diskette that contains programs that have been duplicated on another diskette.

(A) Disk Drive operation is erratic. Clean the heads. Check the Drive Spindle speed, see "Miscellaneous Adjustments". Check Connector J1 on Fixed Disk/Floppy Diskette Adapter Board and Connectors J1 thru J4 on Disk Drive Board for good connections.

(B) Drive dead. Check for 12V at pin 1 and 5V at pin 4 of Connector J2 on Disk Drive Board. If the voltages are missing, check Power Supply.

(C) If voltages check good at pins 1 and 4 of Connector J2, run the following program and check for logic Low at pins 12 and 16 of Connector J1 on Disk Drive Board.

```
10 OUT 1014,128:OUT 1010,20:GOTO 10
```

PRELIMINARY SERVICE CHECKS (Continued)

SWITCHES AND JUMPERS (Continued)

Enhanced Graphics and Monochrome/Printer Adapters are Installed in the System. Enhanced Graphics Adapter is the Primary Adapter.

EGA Adapter	Monochrome/Printer Adapter	SW1			
		1	2	3	4
Color (40 x 25)	Monochrome or none	Closed	Open	Open	Closed
Color (80 x 25)	Monochrome or none	Open	Open	Open	Closed
Enhanced Color (Normal Mode)	Monochrome or none	Closed	Closed	Closed	Open
Enhanced Color (Enhanced Mode)	Monochrome or none	Open	Closed	Closed	Open

Enhanced Graphics and Monochrome/Printer Adapters are Installed in the System. Monochrome/Printer Adapter is the Primary Adapter.

EGA Adapter	Monochrome/Printer Adapter	SW1			
		1	2	3	4
None	Monochrome	Open	Closed	Closed	Closed
Color (40 x 25)	Monochrome	Closed	Closed	Closed	Closed
Color (80 x 25)	Monochrome	Open	Closed	Closed	Closed
Enhanced Color (Normal Mode)	Monochrome	Closed	Open	Closed	Closed
Enhanced Color (Enhanced Mode)	Monochrome	Open	Open	Closed	Closed

Enhanced Graphics and Color Graphics Adapter are Installed on the System. Enhanced Graphics Adapter is the Primary Adapter.

EGA Adapter	Color Graphics Adapter	SW1			
		1	2	3	4
Monochrome	None	Open	Open	Closed	Open
Monochrome	Color (40 x 25)	Closed	Open	Closed	Open
Monochrome	Color (80 x 25)	Open	Open	Closed	Open

Enhanced Graphics and Color Graphics Adapter are Installed in the System. Color Graphics Adapter is the Primary Adapter.

EGA Adapter	Color Graphics Adapter	SW1			
		1	2	3	4
Monochrome	Color (40 x 25)	Closed	Closed	Open	Closed
Monochrome	Color (80 x 25)	Open	Closed	Open	Closed

PRELIMINARY SERVICE CHECKS (Continued)

SWITCHES AND JUMPERS

SYSTEM BOARD

Switch SW1

Switch SW1 is set according to type of Monitor that is used in the System.

SW1 On (Towards Front)	Color Graphics Monitor
SW 1 Off (Towards Rear)	Monochrome Monitor

Jumper J18

Jumper J18 is set according to the amount of RAM that is installed on the System Board.

J18	Pins 1 and 2 jumpered	512 K RAM
J18	Pins 2 and 3 jumpered	256 K RAM

Jumper J131

Jumper J131 is set according to the size of ROMS U17, U27, U37, and U47.

Four 16K x 8 ROMS used	J131 pins 1 to 8 and 2 to 7 jumpered
Two 32K x 8 ROMS used	J131 pins 3 to 6 and 4 to 5 jumpered

SERIAL/PARALLEL ADAPTER

Jumpers J1 and J2 are used to determine if the board is used as a Primary Serial or Parallel Port or an alternate Serial or Parallel Port.

Primary Serial Port	Connect J1 Pin 3 to 6 and 4 to 5
Alternate Serial Port	Connect J1 Pin 1 to 8 and 2 to 7
Primary Parallel Port	Connect J2 Pin 3 to 6 and 4 to 5
Alternate Parallel Port	Connect J2 Pin 1 to 8 and 2 to 7

ENHANCED GRAPHICS ADAPTER

Jumpers P1 and P3

Jumpers P1 and P3 are set according to the type of Monitor connected to the EGA Adapter. Set the jumpers to short the pins indicated below for the Monitor being used.

Monitor	P1	P3
Enhanced Color Monitor	1,2	1,2
Color or Monochrome Monitor	2,3	1,2

DIP Switch SW1

DIP Switch SW1 is set according to the types of Display Adapter boards and Monitors that are used in the System. One or two Display Adapter Boards and one or two Monitors can be used on the System. If two monitors are used, one must be a Color Monitor and the other a Monochrome Monitor. Two Monitors of the same type cannot be used in the same System. Use the following charts to determine the Switch settings for SW1 for the Adapter Boards and Monitors.

Enchanced Graphics Adapter is the only adapater installed in the System.

	SW1			
EGA Adapter	1	2	3	4
Monochrome	Open	Open	Closed	Open
Color (40 x 25)	Closed	Open	Open	Closed
Color (80 x 25)	Open	Open	Open	Closed
Enhanced Color (Normal Mode)	Closed	Closed	Closed	Open
Enhanced Color (Enhanced Mode)	Open	Closed	Closed	Open

PRELIMINARY SERVICE CHECKS (Continued)

SERVICE CHECKS (Continued)

If the readings are correct replace or troubleshoot Disk Drive. If readings are not correct replace or troubleshoot Fixed Disk/Floppy Diskette Adapter Board.

⑦ PARALLEL PORT (Serial/Parallel Adapter)

(A) Parallel Port not working. Make sure Jumper J2 is set properly, see "Switches and Jumpers".

(B) If Jumper J2 is set properly, check Edge Connector and Connector P2 for good connections. If the connections check good, plug a Parallel Loopback Plug, see "Test Plugs", into Connector P2. Type in and run the following Basic program.

NOTE: Set Jumper J2 to configure the Parallel Port as the primary Parallel Port, see "Switches and Jumpers".

```
10 CLS
20 LOCATE 1,1
30 OUT 888,0:OUT 890,0
40 PRINT"A=";INP(888)
50 PRINT"B=";INP(889)
60 PRINT"C=";INP(890)
70 OUT 888,255:OUT 890,255
80 PRINT"D=";INP(888)
90 PRINT"E=";INP(889)
100 PRINT"F=";INP(890):GOTO 20
```

The program continously checks the parallel interface circuits and displays six numbers (A thru F) on the Monitor screen. With loopback plug plugged into Connector P2, the following numbers should appear on the Monitor screen.

A = 0
B = 55
C = 224
D = 255
E = 207
F = 255

If the numbers are not correct, replace or troubleshoot the Serial/Parallel Adapter Board. If the numbers are correct, check the cable and peripheral that was connected to the Parallel Port.

⑧ SERIAL PORT

(A) Serial Port does not work. Make sure Jumper J1 is set properly, see "Switches and Jumbers".

(B) Check Connector P1 for good connections.

⑨ ERROR 161 ON MONITOR SCREEN

(A) The following message appears on the Monitor screen when the Computer is turned On:

161-Systems Options Not Set-(Run SETUP)

Check Battery M1 and check the Battery Connector J21 for good connections. NOTE: If the Battery is replaced a Setup program must be run to set the time, date, and option information that is stored on CMOS RAM. See the "Systems Options Setup" section of the "General Operating Instructions".

MISCELLANEOUS ADJUSTMENTS

14MHz OSCILLATOR

Connect the input of a frequency counter to one end of Resistor R3. Adjust the 14MHz Adjust Trimmer (C26) for a frequency of 14.318MHz.

HEAD CLEANING INSTRUCTIONS

Use a lint-free cloth or cotton swab dampened with 91% isopropyl alcohol to clean the disk drive heads and dry with a lint-free cloth.

5V ADJUSTMENT

Connect input of a voltmeter to 5.0V Source (pin 4 of Connector P9). Adjust 5.0V Adjust Control (P2) for a voltage of 5.0V.

SPINDLE SPEED ADJUSTMENT

If a Disk Drive Tester which provides a readout of the speed in rpm is being used, adjust the Spindle Speed Control VR1 on the Motor Control Board for a speed of 360 rpm.

If a Disk Drive Tester is not available, center and paste the strobe pattern in Figure 1 on the Drive Motor on the bottom of the Disk Drive. Insert a diskette into the Drive and close the door. Type in and run the program listed under "Continuous Operation of Disk Drive" to keep the Disk Drive running. Use 60-cycle fluorescent lighting to view the strobe pattern. Adjust the Spindle Speed Control VR1 on the Motor Control Board until the strobe pattern appears to stand still.

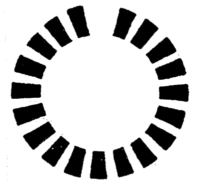


Figure 1

PRELIMINARY SERVICE CHECKS (Continued)

COMPUTER SELF TESTS AND DIAGNOSTICS

COMPUTER SELF-TEST

The Computer performs a self-test every time it is turned On. If no problems are detected, the Computer will beep once and boot up from the Floppy Disk Drive or the Fixed Disk Drive.

If a problem is detected various audio beeps may occur and/or an error code number may appear on the Monitor screen. Use the following charts to determine the area of the problem.

AUDIO	AREA OF PROBLEM
No beep or display	Power Supply
No beep and a blinking cursor.	Power Supply
Beeps continuously	Power Supply
Repeating short beeps	Power Supply
One long and two short beeps	Display Adapter
Two short beeps and Monitor display is blank or not correct	Display Adapter

(X = Alphanumeric character)

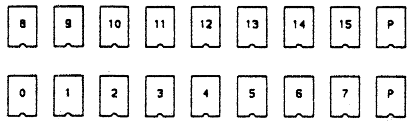
ERROR CODE	AREA OF PROBLEM
1XX	System Board
101	Interrupt Failure
151 or 161	New Battery (M1) installed or defective Battery
162	System Options Error, run Setup program
163	Date and Time not set, run Setup program
164	Memory Size Error
199	Option Setup Error, run Setup program
20X or XXXXXX XXXX 20X	Memory
30X or XX30X	Keyboard
301	Keyboard cable or Keyboard
XX301	Key Stuck
303 or 304	Keyboard Interface on System Board
4XX	Monochrome Display Adapter
5XX	Color/Graphics Display Adapter
6XX	Disk Drive
7XX	Math Coprocessor (U76)
9XX	Parallel Port on Serial/Parallel Adapter
10XX	Alternate Parallel Port on Serial/Parallel Adapter
11XX	Serial Port on Serial/Parallel Adapter
12XX	Alternate Serial Port on Serial/Parallel Adapter
13XX	Game Control Adapter
14XX	Graphics Printer
15XX	Synchronous Data Link Control (SDLC) Communications Adapter
17XX	Fixed (Hard) Disk Drive
20XX	Binary Synchronous Communications (BSC) Adapter
21XX	Alternate BSC Adapter
29XX	Color Printer
Parity Check	Memory
Incorrect Memory Size Displayed	Memory
ROM Error	Defective ROM (U27, U47)
IO ROM XXXXXX	Defective IO Adapter

When a RAM failure occurs, an alphanumeric code will be displayed on the Monitor screen. This code will be 10 characters followed by 20X. The 20X number indicates it is a memory failure. The first two characters indicate which board and which bank on the board has the bad memory. Use the following chart to find the board.

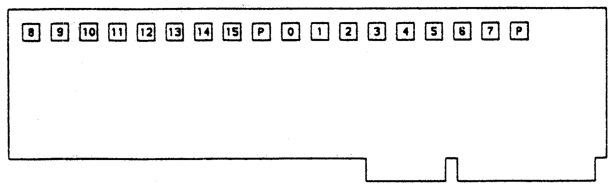
First Two Characters	Board	Bank
00,01,02,03	System	0
04,05, 06, 07	System	1
08 or 09	128K Memory Expansion	
10,11,12,13	1st 512K Memory Adapter	0
14,15,16,17	1st 512K Memory Adapter	1
18,19, 1A,1B	2nd 512K Memory Adapter	0
1C,1D,1E,1F	2nd 512K Memory Adapter	1
20,21,22,23	3rd 512K Memory Adapter	0
24,25,26,27	3rd 512K Memory Adapter	1
28,29,2A,2B	4th 512K Memory Adapter	0
2C,2D,2E,2F	4th 512K Memory Adapter	1
30,31,32,33	5th 512K Memory Adapter	0
34,35,36,37	5th 512K Memory Adapter	1

The last four characters indicate the failing IC. Use the following charts to locate the bad IC.

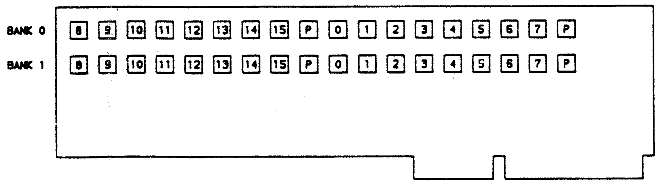
SYSTEM BOARD



128K MEMORY EXPANSION



512K MEMORY ADAPTER


BANK 0
8 9 10 11 12 13 14 15 P 0 1 2 3 4 5 6 7 P
BANK 1
8 9 10 11 12 13 14 15 P 0 1 2 3 4 5 6 7 P

PRELIMINARY SERVICE CHECKS (Continued)

COMPUTER SELF TESTS AND DIAGNOSTICS (Continued)

Last Four Character	IC	Last Four Characters	IC
0000	P	0100	8
0001	0	0200	9
0002	1	0400	10
0004	2	0800	11
0008	3	1000	12
0010	4	2000	13
0020	5	4000	14
0040	6	8000	15
0080	7		

DISASSEMBLY INSTRUCTIONS

CABINET REMOVAL

Remove five screws from rear of cabinet. Slide cabinet forward and remove from unit.

POWER SUPPLY REMOVAL

Disconnect Connectors P8 and P9 from System Board and Connectors P10 and P11 from Disk Drives. Remove four screws from rear of the Power Supply cabinet. Push Power Supply forward about 1/2 inch to clear mounting tabs on cabinet bottom and lift Power Supply from unit.

FLOPPY DISK DRIVE REMOVAL

Disconnect Disk Drive Adapter Connector and ground Connector. Disconnect Power Supply Connector P11 from the rear of the Disk Drive. Remove two screws from the front of Disk Drive A and slide Disk Drive out the front of cabinet.

FIXED DISK DRIVE REMOVAL

Disconnect two Fixed Disk Drive Adapter Connectors, ground Connector and Power Supply Connector (P10) from rear of Fixed Disk Drive. Remove two screws from the front of Drive and slide Drive out front of cabinet.

SYSTEM BOARD REMOVAL

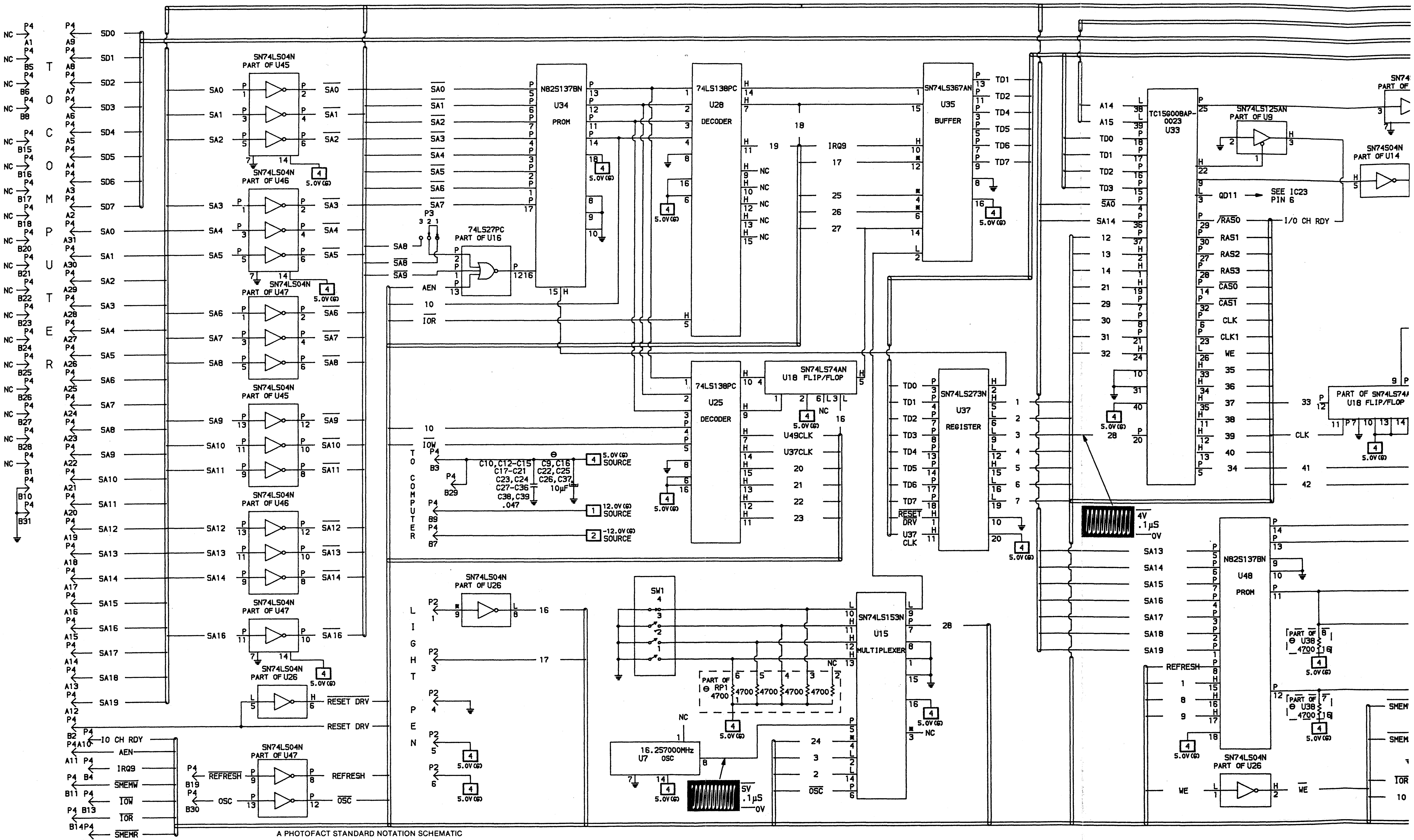
Remove all adapter boards from the expansion slots. Disconnect Battery Connector (J21), Power Supply Connectors (P8 and P9), Speaker Connector (J19) and security Key Lock Connector (J20). Remove two screws located at center top and center bottom on System Board. Slide System Board to left to clear plastic stand-offs on Chassis Bottom. Lift system board out of chassis.

KEYBOARD DISASSEMBLY

Lay Keyboard face down and remove four screws holding lower case. Carefully lift up on rear edge of lower case until it is high enough to slide keyboard cable out. Slide cable out of slot and continue lifting on rear edge until latching tabs on front edge release. The key caps may be removed by lifting up on cap from top of Keyboard.

POWER SUPPLY DISASSEMBLY

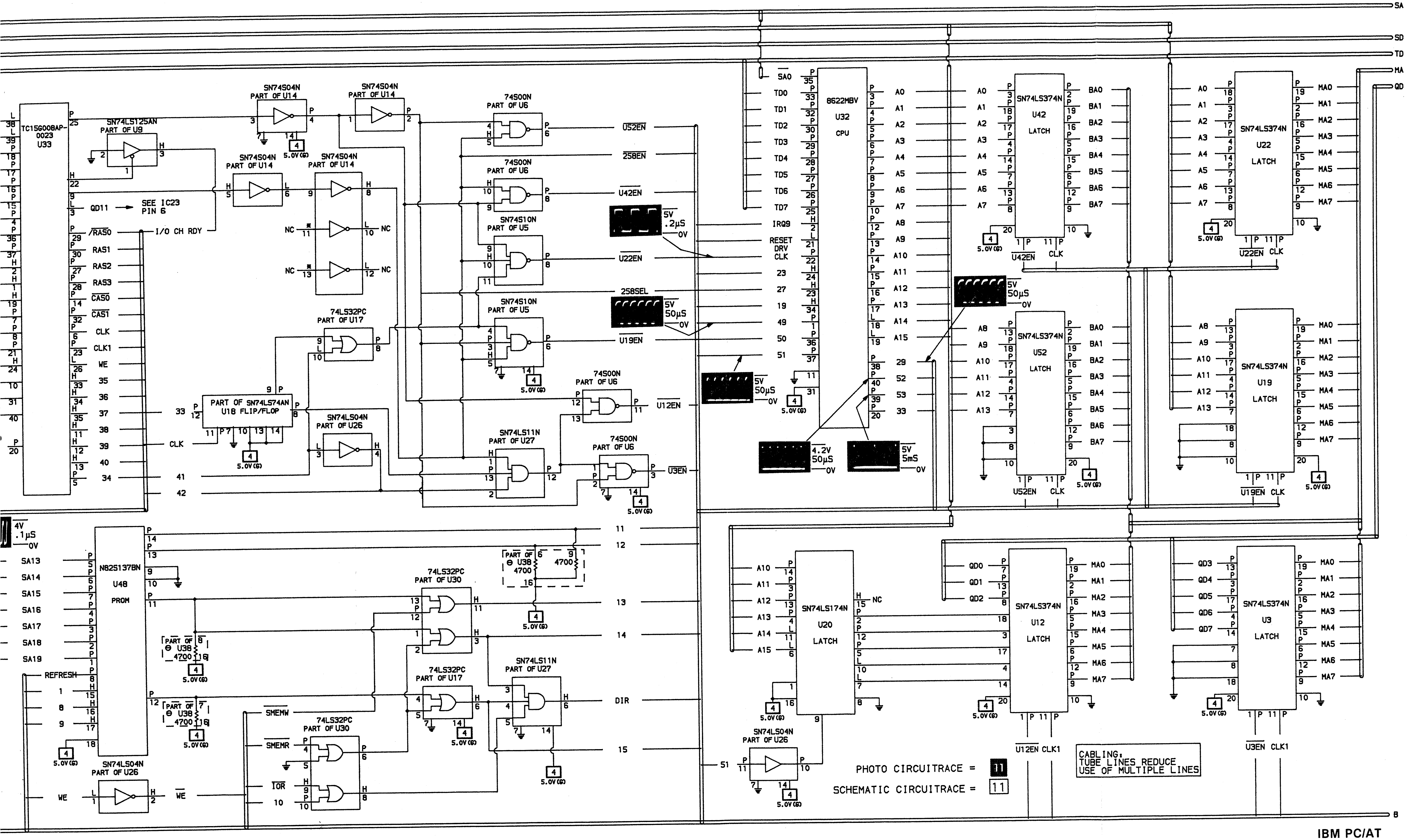
Drill out two rivets on front and top of Power Supply Cabinet. Remove one screw from top and three screws from front of cabinet and lift top off. Squeeze cable strain relief and slide out of cabinet. Remove four screws holding Fan. Disconnect AC power Connectors (E26 and E27) from Main Power Supply Board. Remove nut holding ground wire to cabinet. Remove three screws holding Main Power Supply Board and remove from cabinet. Unsolder five wires connected to AC Input Board. Remove three nuts holding AC Input Board and remove board.


TO COMPUTER
SD0
SD1
SD2
SD3
SD4
SD5
SD6
SD7
SA0
SA1
SA2
SA3
SA4
SA5
SA6
SA7
SA8
SA9
SA10
SA11
SA12
SA13
SA14
SA15
SA16
SA17
SA18
SA19
IO CH RDY
AEN
IRQ9
SMEMW
IOW
IOR
SMEMR
SN74LS04N PART OF U45
SN74LS04N PART OF U46
SN74LS04N PART OF U47
SN74LS04N PART OF U26
RESET DRV
REFRESH
OSC
N82S137BN U34 PROM
74LS27PC PART OF U16
74LS138PC U28 DECODER
74LS138PC U25 DECODER
SN74LS367AN U35 BUFFER
SN74LS74AN U18 FLIP/FLOP
SN74LS273N U37 REGISTER
U49CLK
U37CLK
C10,C12-C15 C17-C21 C23,C24 C27-C36 C38,C39 .047
C9,C16 C22,C25 C26,C37 10µF
5.0V(G) SOURCE
12.0V(G) SOURCE
-12.0V(G) SOURCE
LIGHT PEN
SW1
PART OF RP1 4700
SN74LS153N U15 MULTIPLEXER
16.257000MHz U7 OSC
5V .1µS 0V
4V .1µS 0V
TC15G008AP-0023 U33
SN74LS125AN PART OF U9
SN74S04N PART OF U14
QD11 → SEE IC23 PIN 6
/RAS0
RAS1
RAS2
RAS3
CAS0
CAS1
CLK
CLK1
WE
I/O CH RDY
PART OF SN74LS74 U18 FLIP/FLOP
N82S137BN U48 PROM
PART OF U38 4700
SN74LS04N PART OF U26
TD0
TD1
TD2
TD3
TD4
TD5
TD6
TD7
SMEM
10

A PHOTOFACT STANDARD NOTATION SCHEMATIC

WITH CIRCUITRACE

ENHANCED GRAPHICS ADAPTER


SA
SD
TD
MA
QD
B
TC15G008AP-0023
U33
SN74LS125AN
PART OF U9
SN74S04N
PART OF U14
74S00N
PART OF U6
SN74S10N
PART OF U5
74LS32PC
PART OF U17
PART OF SN74LS74AN
U18 FLIP/FLOP
SN74LS04N
PART OF U26
SN74LS11N
PART OF U27
QD11
SEE IC23 PIN 6
I/O CH RDY
/RAS0
RAS1
RAS2
RAS3
CAS0
CAS1
CLK
CLK1
WE
U52EN
258EN
U42EN
U22EN
258SEL
U19EN
U12EN
U3EN
5V
.2µS
0V
50µS
4.2V
5mS
8622MBV
U32
CPU
SA0
TD0
TD1
TD2
TD3
TD4
TD5
TD6
TD7
IRQ9
RESET DRV
SN74LS374N
U42
U52
U22
U19
U12
U3
LATCH
BA0
BA1
BA2
BA3
BA4
BA5
BA6
BA7
MA0
MA1
MA2
MA3
MA4
MA5
MA6
MA7
QD0
QD1
QD2
QD3
QD4
QD5
QD6
QD7
N82S137BN
U48
PROM
SA13
SA14
SA15
SA16
SA17
SA18
SA19
REFRESH
PART OF U38
4700
DIR
SMEMW
SMEMR
IOR
SN74LS174N
U20
NC
5.0V(G)
4V
.1µS
CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11

ENHANCED GRAPHICS ADAPTER

**IBM PC/AT
MODEL 5170-239**

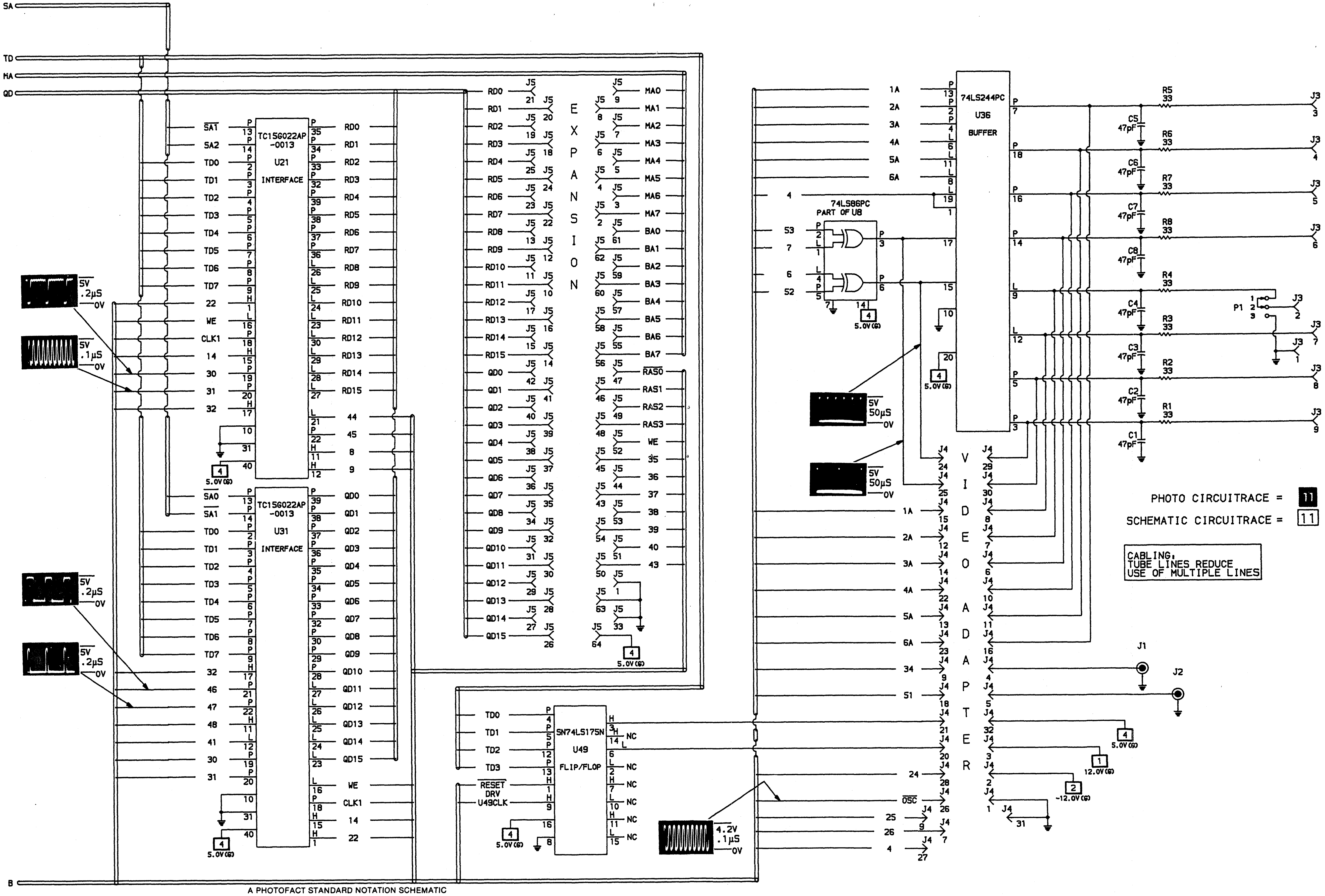

SA
TD
MA
QD
B
TC1S6022AP
-0013
U21
INTERFACE
U31
74LS244PC
U36
BUFFER
74LS86PC
PART OF U8
SN74LS175N
U49
FLIP/FLOP
E X P A N S I O N
V I D E O A D A P T E R
T O M O N I T O R
J1
J2
J3
J4
J5
P1
R1 33
R2 33
R3 33
R4 33
R5 33
R6 33
R7 33
R8 33
C1 47pF
C2 47pF
C3 47pF
C4 47pF
C5 47pF
C6 47pF
C7 47pF
C8 47pF
5V
.2µS
.1µS
50µS
4.2V
0V
5.0V
12.0V
-12.0V
RESET DRV
U49CLK
OSC
NC

PHOTO CIRCUITRACE = 11

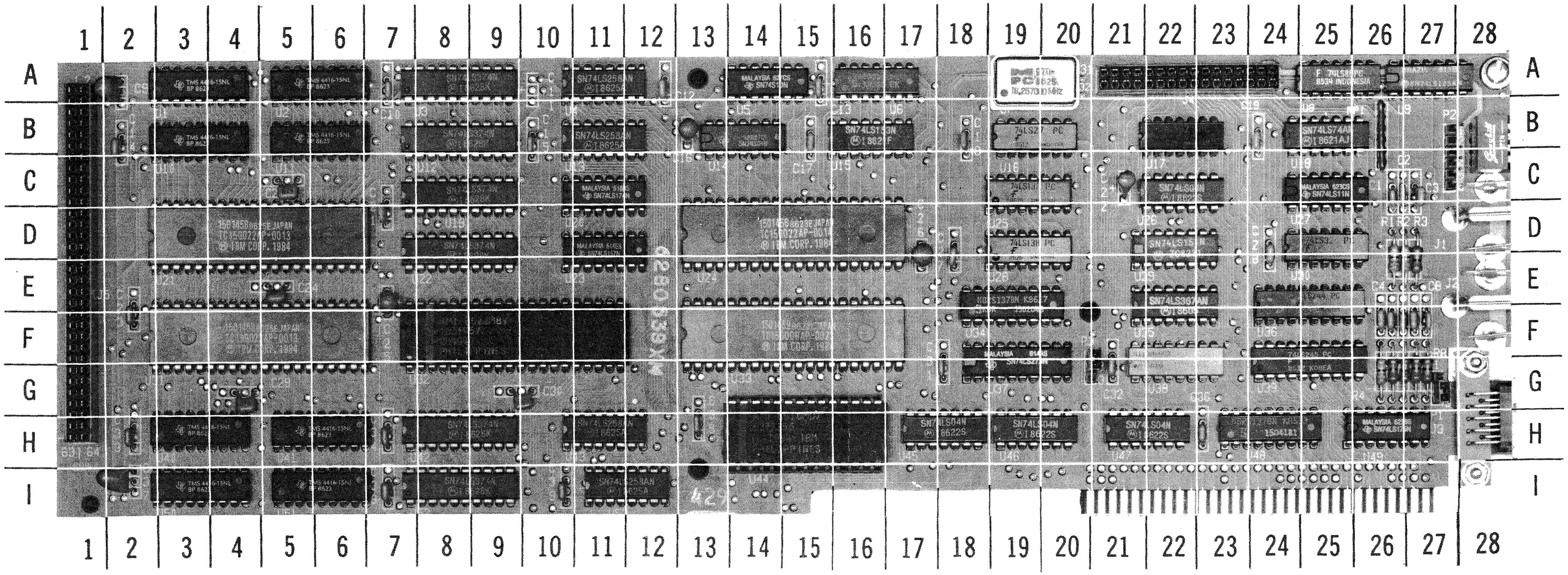
SCHEMATIC CIRCUITRACE = 11

CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES

CSCS17-A

IBM PC/AT
MODEL 5170-239

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE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A
B
C
D
E
F
G
H
I

IBM PC/AT
MODEL 5170-239

A Howard W. Sams GRIDTRACE™ Photo

LOGIC CHART (Continued)

EGA

PIN NO.	IC U44	PIN NO.	IC U44	IC U45	IC U46	IC U47	IC U48	IC U49	IC U50	IC U51	IC U52	IC U53
1	H	21	P	P	P	P	P	H	L	L	P	P
2	P	22	H	P	P	P	P	L	P	L	P	P
3	P	23	P	P	P	P	P	H	P	L	L	P
4	P	24	P	P	P	P	P	P	H	H	P	P
5	P	25	P	P	P	P	P	P	P	P	P	P
6	P	26	P	P	P	P	P	L	P	P	P	L
7	P	27	H	L	L	L	P	H	P	P	P	P
8	P	28	H	P	P	P	P	L	P	P	L	L
9	P			P	P	P	L	H	H	H	P	P
10	P			P	P	P	L	L	P	P	L	P
11	P			P	P	P	P	H	P	P	P	P
12	P			P	P	P	P	P	P	P	P	P
13	P			P	P	P	P	P	P	P	P	P
14	L			H	H	H	P	H	P	P	P	P
15	P						H	L	P	L	P	H
16	P						H	H	P	P	P	H
17	P						H		P	L	P	
18	P						H		L	L	P	
19	P										P	
20	H										H	

SCHEMATIC NOTES

—*— Circuitry not used in some versions
--- Circuitry used in some versions
⊖ See parts list
⏚ Ground
⫫ Chassis
▽ Common tie point

Voltages, waveforms, and logic readings taken with Computer in Power-Up Mode, no keys pressed, no diskette in Drive A, Fixed Disk Formatted with no programs on it. The following messages appear on the Monitor screen:

00256KB OK
161-System Options Not Set-(Run SETUP)
(RESUME="F1" KEY)

Readings on EGA Board taken with Switches and Jumpers on EGA Board set for 80 X 25 Color Monitor.

Waveforms and voltages taken from ground, unless noted otherwise.

Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on "0" reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7.5cm. width with DC reference voltage given at the bottom line of each waveform.

Time in uSec. per cm, given with p-p reading at the end of each waveform.

Item numbers in rectangles appear in the alignment/adjustment instructions.

Supply voltage maintained as shown at input.

Voltages measured with digital meter, no signal.

Controls adjusted for normal operation.

Terminal identification may not be found on unit.

Capacitors are 50 volts or less, 5% unless noted.

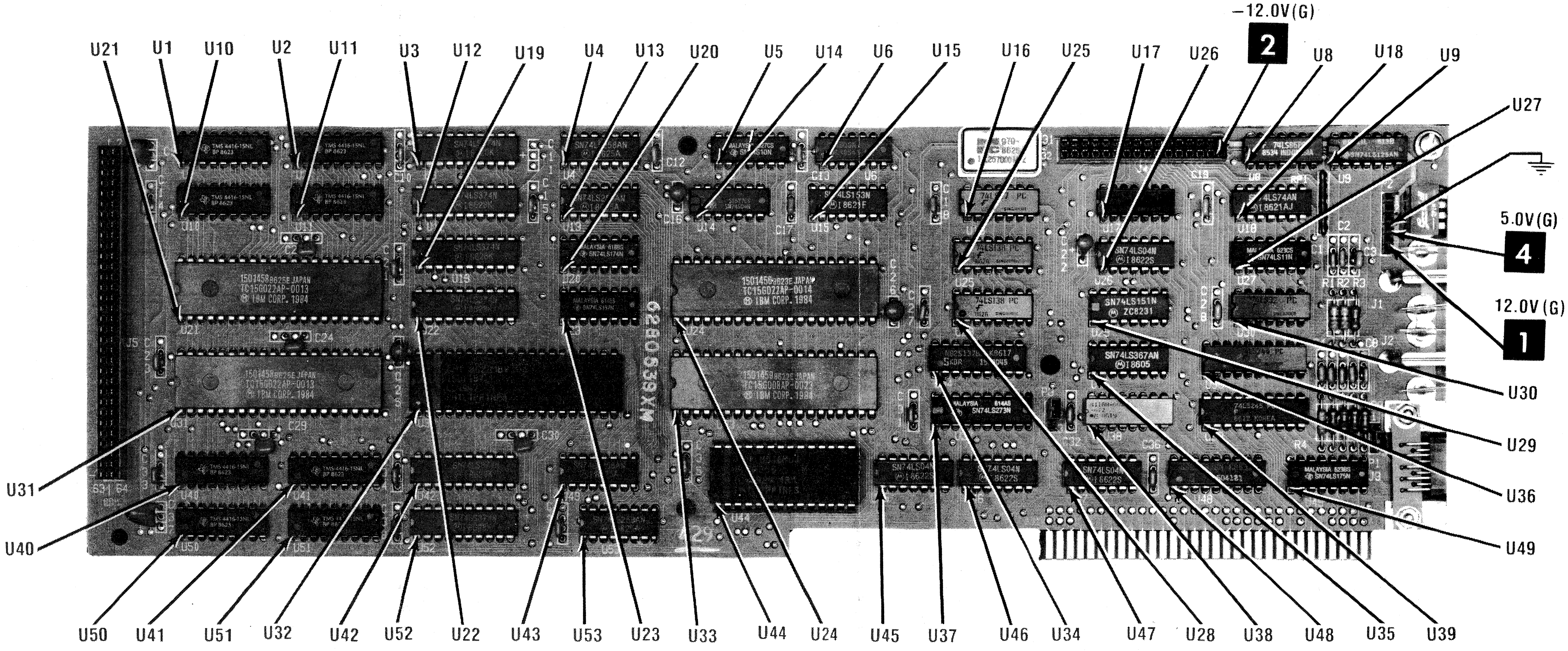
Value in () used in some versions.

Measurements with switching as shown, unless noted.

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No lights On)

ENHANCED GRAPHICS ADAPTER
GridTrace LOCATION GUIDE

C1	C-26
C2	C-26
C3	C-27
C4	F-26
C5	F-26
C6	F-26
C7	F-27
C8	F-27
C9	A-2
C10	A-7
C12	A-12
C13	A-15
C14	B-2
C15	B-10
C16	B-13
C17	B-15
C18	B-18
C19	B-24
C20	C-5
C21	D-7
C22	C-21
C23	F-2
C24	E-5
C25	E-7
C26	D-17
C27	E-18
C28	D-24
C29	G-4
C30	G-10
C31	G-18
C32	G-21
C33	H-2
C34	H-7
C35	H-13
C36	H-23
C37	I-2
C38	I-7
C39	I-10
J1	D-28
J2	E-28
J3	H-28
J4	A-22
J5	E-1
P1	G-27
P2	C-27
P3	G-21
P4	I-24
R1	E-26
R2	E-27
R3	E-27
R4	G-26
R5	G-26
R6	G-27
R7	G-27
R8	G-27
RP1	B-27
SW1	B-28
U1	A-3
U2	A-5
U3	A-8
U4	A-11
U5	A-14
U6	A-16
U7	A-19
U8	A-25
U9	A-27
U10	B-3
U11	B-5
U12	B-8
U13	B-11
U14	B-14
U15	B-16
U16	B-19
U17	B-22
U18	B-25
U19	C-8
U20	C-11
U21	D-4
U22	D-8
U23	D-11
U24	D-14
U25	C-19
U26	C-22
U27	C-25
U28	D-19
U29	D-22
U30	D-25
U31	F-4
U32	F-8
U33	F-14
U34	E-19
U35	E-22
U36	E-24
U37	G-19
U38	G-22
U39	G-24
U40	H-3
U41	H-5
U42	H-8
U43	H-11
U44	H-14
U45	H-17
U46	H-19
U47	H-21
U48	H-24
U49	H-26
U50	I-3
U51	I-5
U52	I-8
U53	I-11


U21
U1
U10
U2
U11
U3
U12
U19
U4
U13
U20
U5
U14
U6
U15
U16
U25
U17
U26
−12.0V(G)
2
U8
U18
U9
U27
5.0V(G)
4
12.0V(G)
1
U30
U29
U36
U49
U31
U40
U50
U41
U51
U32
U42
U52
U22
U43
U53
U23
U33
U44
U24
U45
U37
U46
U34
U47
U28
U38
U48
U35
U39

IBM PC/AT
MODEL 5170-239

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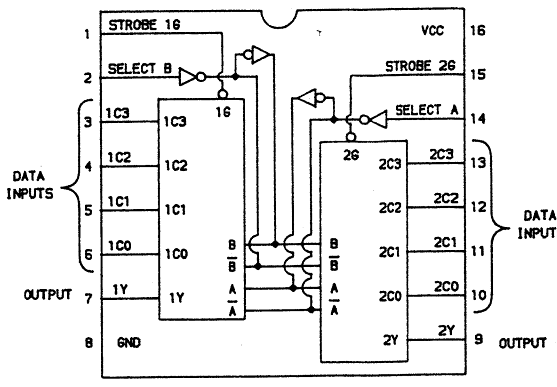
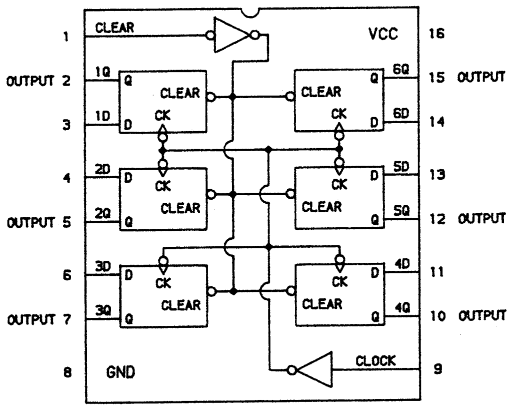
IC PINOUTS & TERMINAL GUIDES

SN74S153N


STROBE 1G
SELECT B
DATA INPUTS
OUTPUT
GND
VCC
STROBE 2G
SELECT A
DATA INPUTS
OUTPUT

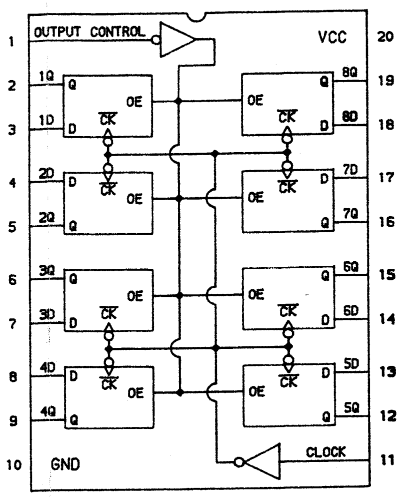
U15
MULTIPLEXER
TOP VIEW

SN74LS174N


CLEAR
OUTPUT
GND
VCC
CLOCK
OUTPUT

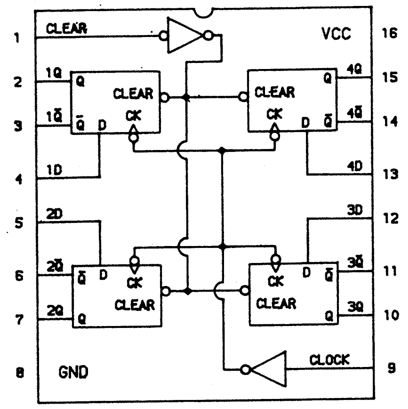
U20
LATCH
TOP VIEW

SN74LS374N


OUTPUT CONTROL
GND
VCC
CLOCK

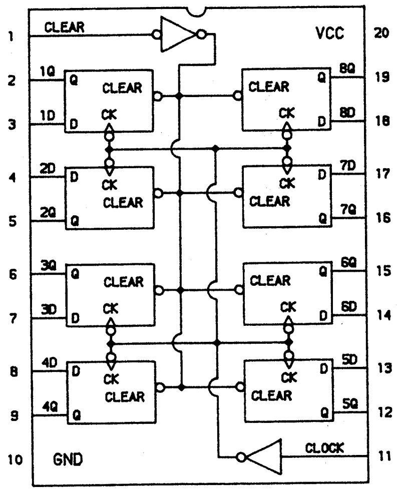
U3,U12,U19,U22,U42,U52
LATCH
TOP VIEW

SN74LS175N


CLEAR
GND
VCC
CLOCK

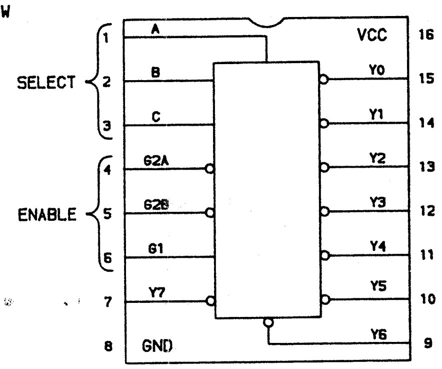
U49
FLIP/FLOP
TOP VIEW

SN74LS273N


CLEAR
GND
VCC
CLOCK

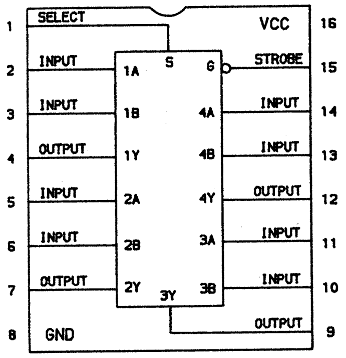
U37
REGISTER
TOP VIEW

74LS138PC


SELECT
ENABLE
GND
VCC

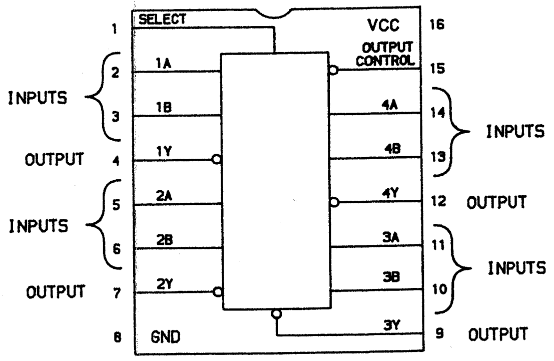
U25,U28
DECODER
TOP VIEW

SN74LS157N


SELECT
INPUT
OUTPUT
GND
VCC
STROBE

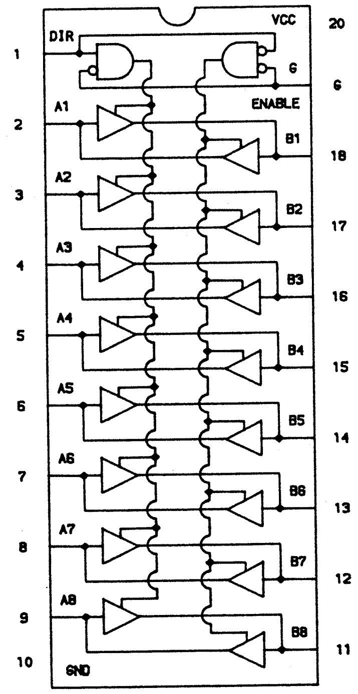
U23
MULTIPLEXER
TOP VIEW

SN74LS258AN

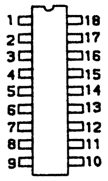

SELECT
INPUTS
OUTPUT
GND
VCC
OUTPUT CONTROL

U4,U13,U43,U53
MULTIPLEXER
TOP VIEW

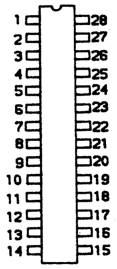
74LS245PC


DIR
ENABLE
GND
VCC

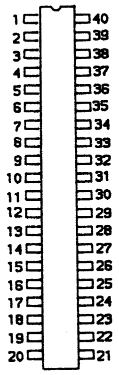
U39
TRANSCEIVER
TOP VIEW



U34,U48
TOP VIEW

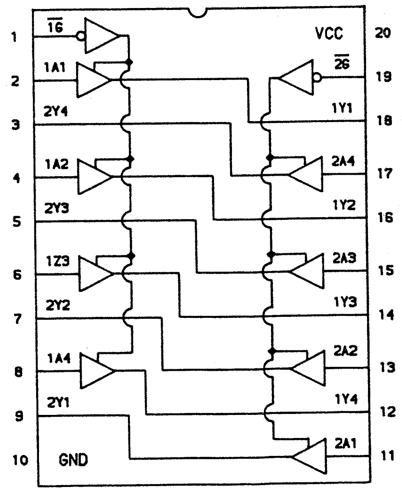


U44
TOP VIEW



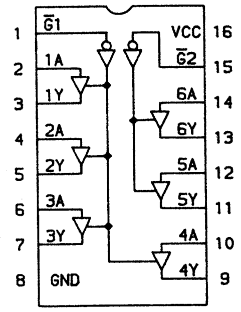
U21,U24,U31,U32,U33
TOP VIEW

74LS244PC



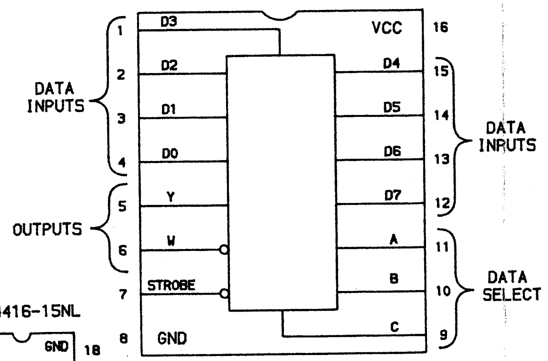
U36
BUFFER
TOP VIEW

SN74LS367AN



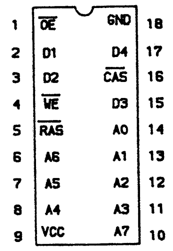
U35
BUFFER
TOP VIEW

SN74LS151N

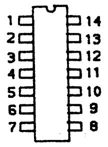

DATA INPUTS
OUTPUTS
STROBE
GND
VCC
DATA INPUTS
DATA SELECT

U29
MULTIPLEXER
TOP VIEW

TMS4416-15NL

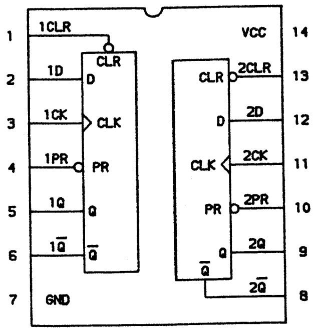

OE
GND
CAS
WE
RAS
VCC

U1,U2,U10,U11,U40,U41,U50,U51
RAM
TOP VIEW



U5,U6,U8,U9,
U14,U16,U17,U26,U27,
U30,U45,U46,U47
TOP VIEW

SN74LS74AN


1CLR
1D
1CK
1PR
1Q
GND
VCC
2CLR
2D
2CK
2PR
2Q

U18
FLIP/FLOP
TOP VIEW

TROUBLESHOOTING

USING A PRINTER FOR DISPLAY

If there is a defect in the EGA Adapter Board, information that is normally displayed on the Monitor screen may not be visible or readable. In such cases it may be possible to send the Monitor screen information to a Printer that is connected to the Computer. While the Computer is in MS-DOS or Basic the Printer output can be turned On by holding the Ctrl Key down and pressing the PrtSc Key. The Monitor screen information will continue to be printed out until the Ctrl and PrtSc Key a pressed again to turn the Printer Off. It is also possible to get a printout of the entire screen display by holding the Shift Key down and pressing the PrtSc Key.

Any Basic program that uses the PRINT command to send information to the Monitor screen can be made to send the information to a Printer by changing the PRINT command to LPRINT.

EGA BOARD SETUP

All readings and troubleshooting were done with the EGA Board set for an 80 X25 color Monitor.

OSCILLATOR

Verify that the 16.257MHz Oscillator (U7) is working by checking for a 16.257MHz waveform at pin 5 of Multiplexer IC (U15).

VIDEO SYNC

No horizontal sync. Check for a horizontal waveform at pin 40 of CPU IC (U32). If the waveform is missing, check IC U32. If the waveform is present, check the waveform at pin 6 of IC U8. If the waveform is missing, check IC U8. If the waveform checks good, check for a logic Low at pin 1 and pulses at pin 5 of Buffer IC (U36). If the reading is not correct at pin 1, check the Register IC (U37). If the reading is correct at pin 1 and pulses are missing at pin 5, check IC U36 and Capacitor C2. If pulses are present at pin 5, check Resistor R2 and check pin 8 of Connector J3 for good connections.

No vertical sync. Check for a vertical waveform at pin 39 of IC U32. If the waveform is missing, check IC U32. If the waveform checks good, check the waveform at pin 8 of IC U8. If the waveform is missing, check IC U8. If the waveform is present, check for a logic Low at pin 1 and pulses at pin 3 of IC U36. If the reading is not correct at pin 1, check Register IC U37. If the reading is correct at pin 1 and pulses are missing at pin 3, check IC U36 and Capacitor C1. If pulses are present at pin 3, check Resistor R1 and check pin 9 of Connector J3 for good connections.

COLOR

Colors not correct. Type in and run the following Basic program. The program puts blue, green, and red horizontal bars on the Monitor screen.

```
 10 DATA 9,10,12
 20 SCREEN 0,1:WIDTH 40
 30 KEY OFF:CLS
 40 FOR Y=1 TO 3
 50 READ C
 60 COLOR 0,C
 70 FOR X=1 TO 320
 80 PRINT " ";
 90 NEXT X:NEXT Y
100 GOTO 100
```

While the program is running, check for pulses at pins 19, 21, and 22 of Interface IC U24. If pulses are missing, check IC U24. If pulses are present, check for pulses at pins 7, 16, and 18 of IC U36. If pulses are missing, check IC U36 and Capacitors C5, C6, and C7. If pulses are present, check Resistors R5, R6, and R7 and check pins 3, 4, and 5 of Connector J3 for good connections.

LOGIC CHART (Continued)

EGA

PIN NO.	IC U25	IC U26	IC U27	IC U28	IC U29	IC U30	IC U31	PIN NO.	IC U31	IC U32	PIN NO.	IC U32
1	P	L	H	P	P	P	H	21	P	P	21	L
2	P	H	H	P	H	P	P	22	P	H	22	P
3	P	L	H	P	P	H	P	23	L	P	23	H
4	P	H	H	P	P	P	P	24	L	P	24	H
5	P	L	H	H	P	L	P	25	L	P	25	P
6	H	H	H	H	P	P	P	26	L	P	26	P
7	H	L	L	H	L	L	P	27	L	P	27	P
8	L	L	H	L	L	H	P	28	P	P	28	P
9	H	*	*	H	P	H	P	29	P	P	29	P
10	H	P	*	H	H	P	L	30	P	P	30	P
11	H	P	*	H	H	H	H	31	L	L	31	H
12	H	P	P	H	P	P	L	32	P	P	32	P
13	H	P	P	H	P	P	P	33	P	P	33	P
14	H	H	H	H	P	H	P	34	P	P	34	H
15	H			H	P		H	35	P	P	35	P
16	H			H	H		L	36	P	P	36	P
17							H	37	P	P	37	P
18							P	38	P	L	38	P
19							P	39	P	L	39	P
20							P	40	H	P	40	P

PIN NO.	IC U33	PIN NO.	IC U33	IC U34	IC U35	IC U36	IC U37	IC U39	IC U40	IC U41	IC U42	IC U43
1	H	21	P	P	H	L	H	H	L	L	P	P
2	H	22	H	P	L	P	H	P	P	P	P	P
3	L	23	P	P	P	P	P	P	P	P	P	L
4	P	24	H	P	*	P	P	P	H	H	P	P
5	P	25	P	P	P	P	H	P	P	P	P	P
6	P	26	L	P	*	L	L	P	P	P	P	P
7	P	27	P	P	P	P	P	P	P	P	P	P
8	P	28	P	L	L	L	P	P	P	P	P	L
9	H	29	P	L	P	L	L	P	H	H	P	P
10	L	30	P	L	H	L	L	L	P	P	L	P
11	H	31	L	P	P	L	H	P	P	P	P	P
12	H	32	P	P	*	L	L	P	P	P	P	P
13	H	33	H	P	P	P	P	P	P	P	P	P
14	P	34	H	P	H	L	P	P	P	P	P	P
15	P	35	H	H	H	P	H	P	P	P	P	H
16	P	36	P	P	H	P	L	P	P	P	P	H
17	P	37	P	P		P	P	P	P	L	P	
18	P	38	L	H		P	P	P	L	L	P	
19	H	39	L			L	L	L			P	
20	P	40	H			H	H	H			H	

LOGIC CHART

EGA BOARD

PIN NO.	IC U1	IC U2	IC U3	IC U4	IC U5	IC U6	IC U8	IC U9	IC U10	IC U11	IC U12	IC U13	IC U14
1	L	L	P	P	P	P	L	H	L	L	P	P	P
2	P	L	P	P	P	P	P	L	P	L	P	P	P
3	P	L	P	P	P	P	P	H	P	L	P	P	P
4	H	H	P	P	P	P	L	*	H	H	L	P	P
5	P	P	P	P	H	H	P	*	P	P	P	P	H
6	P	P	P	P	P	P	P	*	P	P	P	L	L
7	P	P	L	P	L	L	L	L	P	P	P	P	L
8	P	P	L	L	P	P	L	*	P	P	P	L	H
9	H	H	P	P	P	P	*	*	H	H	P	P	L
10	P	P	L	L	H	H	*	*	P	P	L	P	L
11	P	P	P	P	P	P	L	*	P	P	P	P	*
12	P	P	P	P	P	P	*	*	P	P	P	P	L
13	P	P	P	P	P	P	*	*	P	P	P	P	*
14	P	P	P	P	H	H	H	H	P	P	L	P	H
15	P	L	P	H					P	L	P	H	
16	P	P	P	H					P	P	P	H	
17	P	L	P						P	L	P		
18	L	L	L						L	L	P		
19			P								P		
20			H								H		

PIN NO.	IC U15	IC U16	IC U17	IC U18	IC U19	IC U20	IC U21	PIN NO.	IC U21	IC U22	IC U23	IC U24	PIN NO.	IC U24
1	L	P	*	H	P	H	H	21	L	P	H	H	21	P
2	L	P	*	H	P	P	P	22	P	P	P	P	22	P
3	*	*	H	L	P	P	P	23	L	P	P	L	23	P
4	*	*	P	H	P	P	P	24	L	P	P	L	24	P
5	P	*	P	H	P	P	P	25	L	P	L	L	25	P
6	P	L	H	L	P	L	P	26	L	P	L	L	26	P
7	P	L	L	L	P	L	P	27	L	P	P	P	27	P
8	L	L	P	P	L	L	P	28	L	P	L	P	28	P
9	L	*	P	P	P	P	P	29	L	P	P	P	29	P
10	L	*	L	H	L	L	L	30	L	L	P	P	30	P
11	H	*	H	P	P	L	H	31	L	P	P	H	31	P
12	H	P	*	P	P	P	H	32	P	P	P	H	32	P
13	H	P	*	H	P	P	P	33	P	P	P	P	33	P
14	L	H	H	H	P	P	P	34	P	P	P	P	34	P
15	L				P	H	H	35	P	P	L	P	35	P
16	H				P	H	L	36	P	P	H	L	36	P
17					P		H	37	P	P		L	37	P
18					L		P	38	P	P		L	38	P
19					P		P	39	P	P		P	39	P
20					H		P	40	H	H		L	40	P

PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
EGA VIDEO BOARD						
U1,2	TMS4416-15NL				HE-443-1165	
U3	SN74LS374N	NTE74LS374	ECG74LS374	SK7CT374	HE-443-863	
U4	SN74LS258AN	NTE74LS258	ECG74LS258	SK74LS258		
U5	SN74S10N	NTE74S10	ECG74S10			
U6	74S00N	NTE74S00	ECG74S00	SK74S00	HE-443-26	
U8	74LS86PC	NTE74LS86	ECG74LS86	SK74LS86	HE-443-891	
U9	SN74LS125AN	NTE74LS125A	ECG74LS125A	SK74LS125A	HE-443-811	
U10,11	TMS4416-15NL				HE-443-1165	
U12	SN74LS374N	NTE74LS374	ECG74LS374	SK7CT374	HE-443-863	
U13	SN74LS258AN	NTE74LS258	ECG74LS258	SK74LS258		
U14	SN74S04N	NTE74S04	ECG74S04	SK74S04	HE-443-897	
U15	SN74LS153N	NTE74LS153	ECG74LS153	SK74LS153		
U16	74LS27PC	NTE74LS27	ECG74LS27	SK74LS27	HE-443-800	
U17	74LS32PC	NTE74LS32	ECG74LS32	SK74LS32	HE-443-875	
U18	SN74LS74AN	NTE74LS74A	ECG74LS74A	SK74LS74A	HE-443-730	
U19	SN74LS374N	NTE74LS374	ECG74LS374	SK7CT374	HE-443-863	
U20	SN74LS174N	NTE74LS174	ECG74LS174	SK74LS174	HE-443-879	
U21	TC15G022AP-0013					
U22	SN74LS374N	NTE74LS374	ECG74LS374	SK7CT374	HE-443-863	
U23	SN74LS157N	NTE74LS157	ECG74LS157	SK74LS157	HE-443-799	
U24	TC15G022AP-0014					
U25	74LS138PC	NTE74LS138	ECG74LS138	SK74LS138	HE-443-877	
U26	SN74LS04N	NTE74LS04	ECG74LS04	SK74LS04	HE-443-755	
U27	SN74LS11N	NTE74LS11	ECG74LS11	SK74LS11	HE-443-864	
U28	74LS138PC	NTE74LS138	ECG74LS138	SK74LS138	HE-443-877	
U29	SN74LS151N	NTE74LS151	ECG74LS151	SK74LS151		
U30	74LS32PC	NTE74LS32	ECG74LS32	SK74LS32	HE-443-875	
U31	TC15G022AP-0013					
U32	8622MBV					
U33	TC15G008AP-0023					

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
U34	N82S137BN					
U35	SN74LS367AN	NTE74LS367	ECG74LS367	SK74LS367	HE-443-857	
U36	74LS244PC	NTE74LS244	ECG74LS244	SK74LS244	HE-443-791	
U37	SN74LS273N	NTE74LS273	ECG74LS273	SK74LS273	HE-443-805	
U39	74LS245PC	NTE74LS245	ECG74LS245	SK74LS245	HE-443-885	
U40,1	TMS4416-15NL				HE-443-1165	
U42	SN74LS374N	NTE74LS374	ECG74LS374	SK7CT374	HE-443-863	
U43	SN74LS258AN	NTE74LS258	ECG74LS258	SK74LS258		
U44	8616MDJ					
U45,6,7	SN74LS04N	NTE74LS04	ECG74LS04	SK74LS04	HE-443-755	
U48	N82S137BN					
U49	SN74LS175N	NTE74LS175	ECG74LS175	SK74LS175	HE-443-752	
U50,1	TMS4416-15NL				HE-443-1165	
U52	SN74LS374N	NTE74LS374	ECG74LS374	SK7CT374	HE-443-863	
U53	SN74LS258AN	NTE74LS258	ECG74LS258	SK74LS258		

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

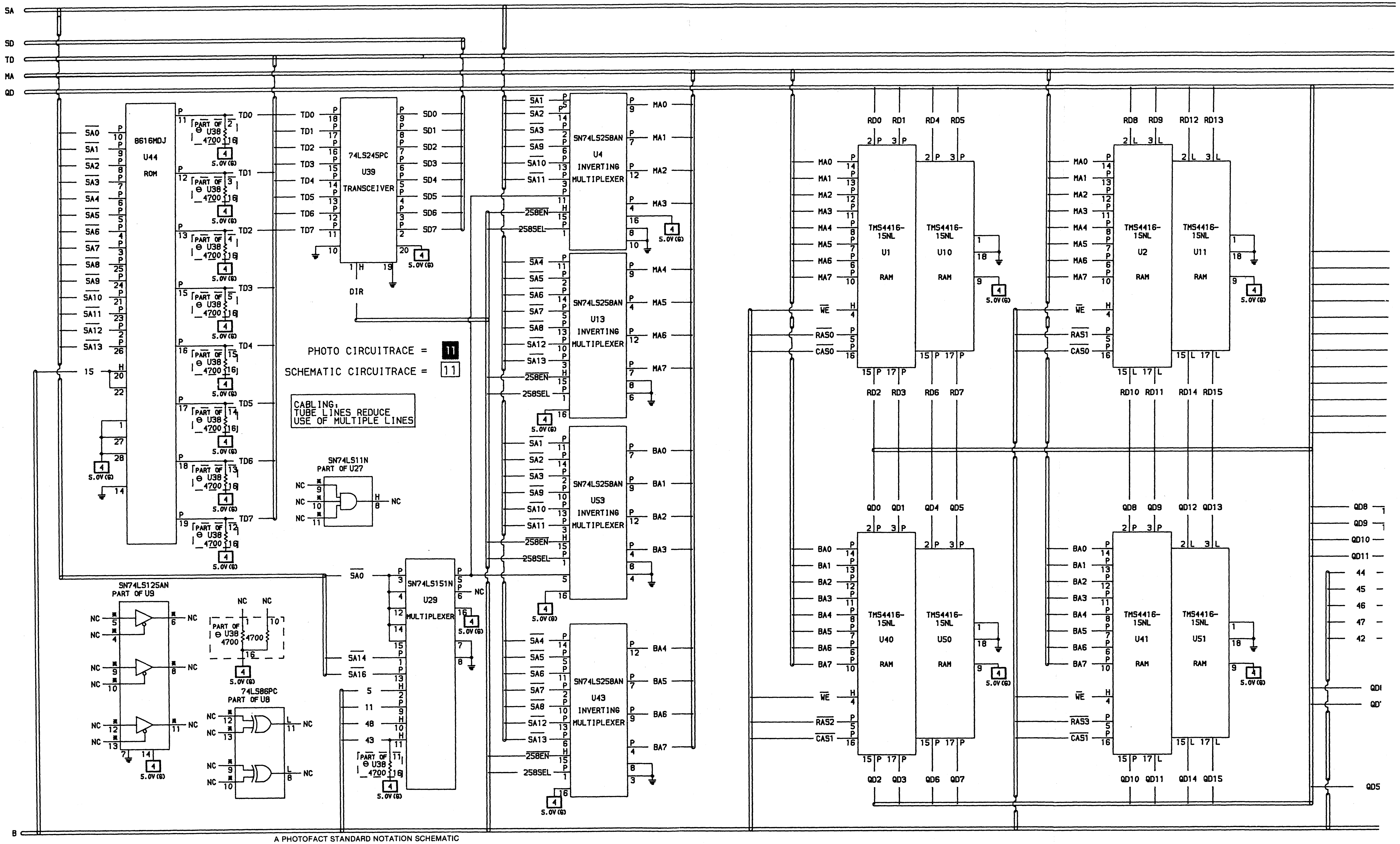
RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
	EGA BOARD			
RP1	Resistor Network	(1)		
U38	Resistor Network	(2)		

(1) 4700 x 5
(2J) 4700 x 15

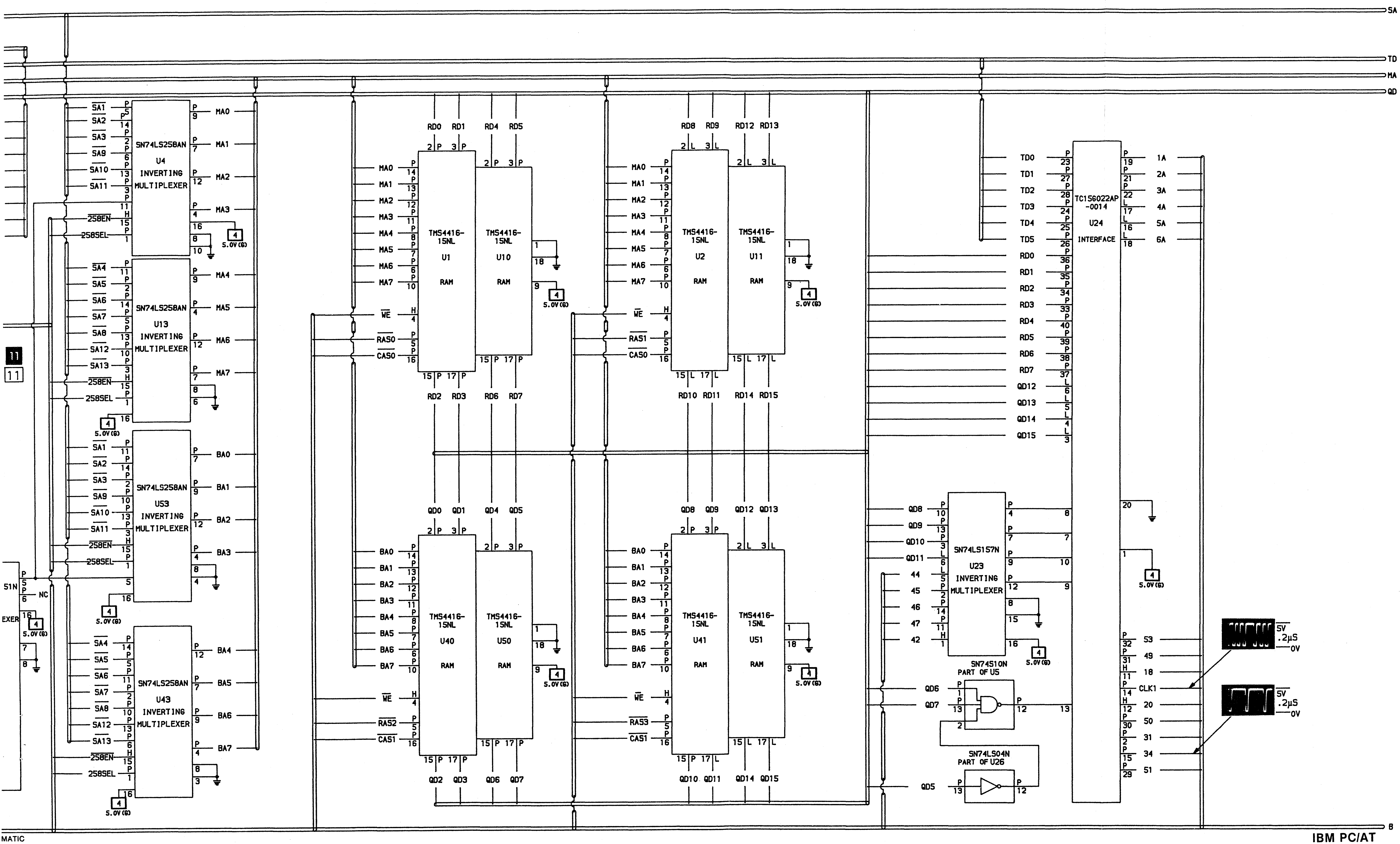
MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
	EGA BOARD		
SW1	Switch		DIP, Configuration
U7	Oscillator		16.257000MHz


SA
SD
TD
MA
QD
B
8616MDJ
U44
ROM
PART OF U38 4700
5.0V(G)
74LS245PC
U39
TRANSCEIVER
DIR
SN74LS258AN
U4
INVERTING MULTIPLEXER
SN74LS258AN
U13
INVERTING MULTIPLEXER
SN74LS258AN
U53
INVERTING MULTIPLEXER
SN74LS258AN
U43
INVERTING MULTIPLEXER
258EN
258SEL
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES
SN74LS11N
PART OF U27
SN74LS125AN
PART OF U9
74LS86PC
PART OF U8
SN74LS151N
U29
MULTIPLEXER
NC
TMS4416-15NL
U1
RAM
TMS4416-15NL
U10
RAM
TMS4416-15NL
U2
RAM
TMS4416-15NL
U11
RAM
TMS4416-15NL
U40
RAM
TMS4416-15NL
U50
RAM
TMS4416-15NL
U41
RAM
TMS4416-15NL
U51
RAM
WE
RAS0
CAS0
RAS1
RAS2
CAS1
RAS3
RD0 RD1 RD4 RD5
RD2 RD3 RD6 RD7
RD8 RD9 RD12 RD13
RD10 RD11 RD14 RD15
QD0 QD1 QD4 QD5
QD2 QD3 QD6 QD7
QD8 QD9 QD12 QD13
QD10 QD11 QD14 QD15

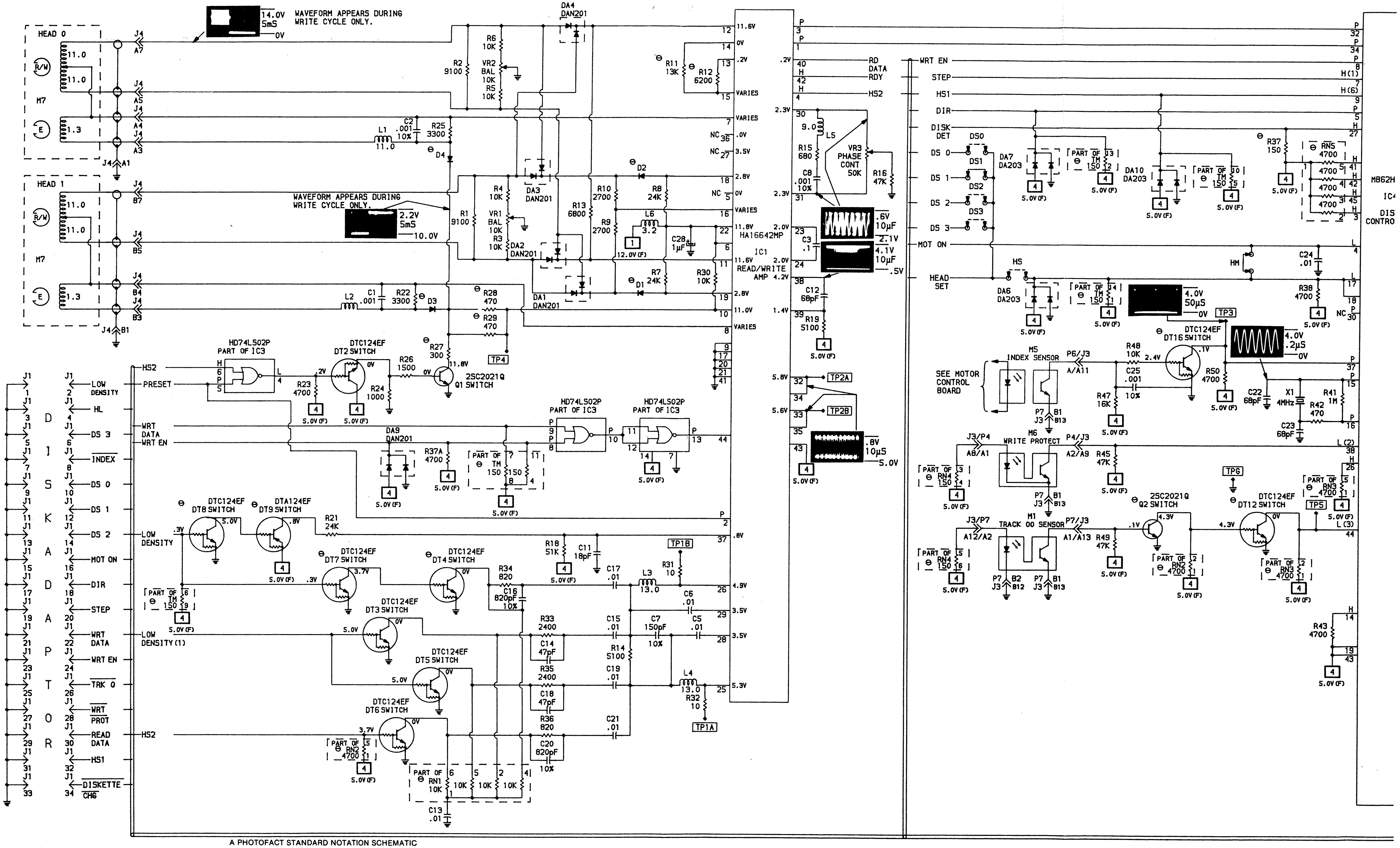
ENHANCED GRAPHICS ADAPTER

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE®


SA
TD
MA
QD
B
SN74LS258AN
U4
INVERTING
MULTIPLEXER
SN74LS258AN
U13
INVERTING
MULTIPLEXER
SN74LS258AN
U53
INVERTING
MULTIPLEXER
SN74LS258AN
U43
INVERTING
MULTIPLEXER
258EN
258SEL
5.0V (G)
TMS4416-15NL
U1
RAM
TMS4416-15NL
U10
RAM
TMS4416-15NL
U2
RAM
TMS4416-15NL
U11
RAM
TMS4416-15NL
U40
RAM
TMS4416-15NL
U50
RAM
TMS4416-15NL
U41
RAM
TMS4416-15NL
U51
RAM
WE
RAS0
CAS0
RAS1
RAS2
CAS1
RAS3
TC156022AP-0014
U24
INTERFACE
SN74LS157N
U23
INVERTING
MULTIPLEXER
SN74S10N
PART OF U5
SN74LS04N
PART OF U26
5V
.2µS
0V
CLK1
NC
51N
EXER
MATIC

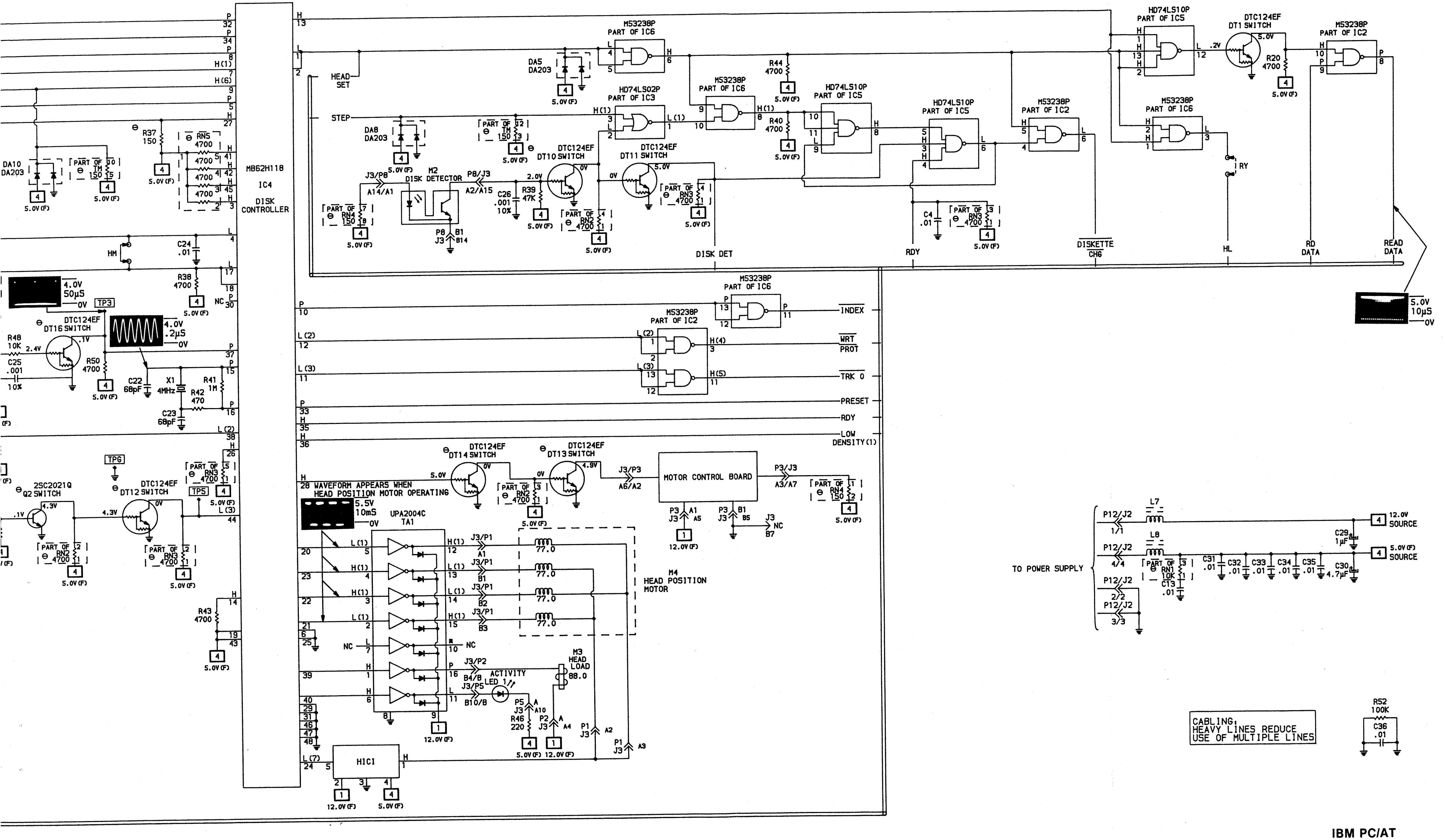
ENHANCED GRAPHICS ADAPTER

IBM PC/AT
MODEL 5170-239


HEAD 0
HEAD 1
R/W
E
M7
11.0
1.3
J4 A7
J4 A5
J4 A4
J4 A3
J4 A1
J4 B7
J4 B5
J4 B4
J4 B3
J4 B1
14.0V 5mS 0V
WAVEFORM APPEARS DURING WRITE CYCLE ONLY.
2.2V 5mS 10.0V
DA4 DAN201
DA3 DAN201
DA2 DAN201
DA1 DAN201
R6 10K
VR2 BAL 10K
R5 10K
R2 9100
R1 9100
R4 10K
VR1 BAL 10K
R3 10K
L1 11.0
C2 .001 10%
R25 3300
D4
L2
C1 .001
R22 3300
D3
R28 470
R29 470
TP4
R10 2700
R9 2700
R13 6800
R8 24K
R7 24K
L6 3.2
C28 1µF
R30 10K
D1
D2
12.0V(F)
R11 13K
R12 6200
HA16642MP
IC1
READ/WRITE AMP
11.6V
0V
.2V
VARIES
3.5V
2.8V
11.0V
NC
RD DATA
RDY
HS2
L5 9.0
R15 680
C8 .001 10%
VR3 PHASE CONT 50K
R16 47K
C3 .1
C12 68pF
R19 5100
.6V 10µF
2.1V
4.1V 10µF
.5V
TP2A
TP2B
.8V 10µS
5.0V
5.0V(F)
HD74LS02P PART OF IC3
DTC124EF DT2 SWITCH
R23 4700
R24 1000
R26 1500
R27 300
2SC2021Q Q1 SWITCH
HS2
PRESET
WRT DATA
WRT EN
DA9 DAN201
R37A 4700
PART OF TM 150
LOW DENSITY
DTC124EF DT8 SWITCH
DTA124EF DT9 SWITCH
R21 24K
DTC124EF DT7 SWITCH
DTC124EF DT4 SWITCH
DTC124EF DT3 SWITCH
DTC124EF DT5 SWITCH
DTC124EF DT6 SWITCH
LOW DENSITY(1)
R18 51K
C11 18pF
TP1B
R31 10
L3 13.0
C17 .01
R34 820
C16 820pF 10%
C6 .01
R33 2400
C15 .01
C7 150pF 10%
C5 .01
C14 47pF
R14 5100
R35 2400
C19 .01
L4 13.0
R32 10
TP1A
C18 47pF
R36 820
C21 .01
C20 820pF 10%
PART OF RN1 10K
C13 .01
PART OF RN2 4700
J1
LOW DENSITY
HL
DS 3
INDEX
DS 0
DS 1
DS 2
MOT ON
DIR
STEP
WRT DATA
WRT EN
TRK 0
WRT PROT
READ DATA
HS1
DISKETTE CHG
D I S K A D A P T O R
WRT EN
STEP
HS1
DIR
DISK DET
DS0
DS1
DS2
DS3
DS 0
DS 1
DS 2
DS 3
DA7 DA203
DA10 DA203
PART OF TM 150
R37 150
RN5 4700
MOT ON
HM
HS
HEAD SET
DA6 DA203
C24 .01
R38 4700
4.0V 50µS 0V
TP3
DTC124EF DT16 SWITCH
4.0V .2µS 0V
SEE MOTOR CONTROL BOARD
M5 INDEX SENSOR
P6/J3 A/A11
R48 10K
C25 .001 10%
R47 16K
R50 4700
C22 68pF
X1 4MHz
R41 1M
R42 470
C23 68pF
M6 WRITE PROTECT
J3/P4 A8/A1
P4/J3 A2/A9
R45 47K
PART OF RN4 150
TP6
TP5
M1 TRACK 00 SENSOR
J3/P7 A12/A2
P7/J3 A1/A13
R49 47K
2SC2021Q Q2 SWITCH
DTC124EF DT12 SWITCH
PART OF RN3 4700
R43 4700
MB62H
IC
DIS
CONTRO

A PHOTOFACT STANDARD NOTATION SCHEMATIC

WITH CIRCUITRACE


MB62H118
IC4
DISK CONTROLLER
HEAD SET
STEP
DA5 DA203
DA8 DA203
DA10 DA203
M53238P PART OF IC6
HD74LS02P PART OF IC3
M53238P PART OF IC6
HD74LS10P PART OF IC5
HD74LS10P PART OF IC5
M53238P PART OF IC2
HD74LS10P PART OF IC5
DTC124EF DT1 SWITCH
M53238P PART OF IC2
M53238P PART OF IC6
M2 DISK DETECTOR
DTC124EF DT10 SWITCH
DTC124EF DT11 SWITCH
R37 150
R44 4700
R40 4700
R20 4700
R39 47K
C26 .001 10%
C4 .01
DISK DET
RDY
DISKETTE CHG
HL
RY
RD DATA
READ DATA
5.0V 10µS 0V
HM
C24 .01
R38 4700
4.0V 50µS 0V
TP3
DTC124EF DT16 SWITCH
R48 10K
C25 .001 10%
R50 4700
4.0V .2µS 0V
C22 68pF
X1 4MHz
R41 1M
R42 470
C23 68pF
INDEX
WRT PROT
TRK 0
PRESET
RDY
LOW DENSITY (1)
M53238P PART OF IC6
M53238P PART OF IC2
TP6
2SC2021Q Q2 SWITCH
DTC124EF DT12 SWITCH
TP5
R43 4700
DTC124EF DT14 SWITCH
DTC124EF DT13 SWITCH
MOTOR CONTROL BOARD
WAVEFORM APPEARS WHEN HEAD POSITION MOTOR OPERATING
5.5V 10mS 0V
UPA2004C TA1
M4 HEAD POSITION MOTOR
77.0
M3 HEAD LOAD 88.0
ACTIVITY LED 1
R46 220
H1C1
12.0V (F)
5.0V (F)
TO POWER SUPPLY
P12/J2
L7
L8
12.0V SOURCE
5.0V (F) SOURCE
C29 1µF
C30 4.7µF
C31 .01
C32 .01
C33 .01
C34 .01
C35 .01
C13 .01
RN1 10K
CABLING: HEAVY LINES REDUCE USE OF MULTIPLE LINES
R52 100K
C36 .01

FLOPPY DISK DRIVE

IBM PC/AT
MODEL 5170-239

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
U57	MC3487N				HE-443-1167	
U58	74LS08NA	NTE74LS08	ECG74LS08	SK74LS08	HE-443-780	
U59	SN74LS14N	NTE74LS14	ECG74LS14	SK74LS14	HE-443-872	
U60	SN74S30N	NTE74S30	ECG74S30			
U61	74LS245NA	NTE74LS245	ECG74LS245	SK74LS245	HE-443-885	
U62	74LS393NA	NTE74LS393	ECG74LS393	SK74LS393	HE-443-973	
U63	74LS245NA	NTE74LS245	ECG74LS245	SK74LS245	HE-443-885	
VR1,2	78M05HC					
DISK DRIVE						
D1 THRU D4		NTE519	ECG519	SK3100/519	103-131	
DA1 THRU DA4	DAN201	NTE519 N2	ECG519 N2	SK3100/519 N2	103-131 N2	
DA5 THRU DA10	DA203	NTE519 N3	ECG519 N3	SK3100/519 N3	103-131 N3	
DT1 THRU DT8	C124EF(DTC124EF)					
DT9	A124EF(DTA124EF)					
DT10 THRU DT14	C124EF(DTC124EF)					
DT16	C124EF(DTC124EF)					
IC1	HA16642MP					
IC2	M53238P	NTE7438	ECG7438	SK7438	HE-443-77	
IC3	HD74LS02P	NTE74LS02	ECG74LS02	SK74LS02	HE-443-779	
IC4	MB62H118					
IC5	HD74LS10P	NTE74LS10	ECG74LS10	SK74LS10	HE-443-797	
IC6	M53238P	NTE7438	ECG7438	SK7438	HE-443-77	
Q1,2	C2021Q(JAPAN)	NTE16	ECG16	SK3911	121-Z9065	
TA1	UPA2004C [uPA2004C]					

* Lead configuration may vary from original.

N2 Two required, connect in series--cathode to cathode.
N3 Two required, connect in series--anode to cathode.

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

CAPACITORS

ITEM No.	RATING	MFGR. PART No.
	FLOPPY DISK CONTROLLER	
C4	68 50V 5%	
	68 NPO 50V 5%	
C5	22 50V 5%	
	22 NPO 50V 5%	
C11	7-80 Trimmer	

ITEM No.	RATING	MFGR. PART No.
C12	120 N1500 500V 5%	
	100 50V 5%	
C21	150 N1500 100V 5%	
	80 50V 5%	
C22	7-50 Trimmer	
C37	4-20 Trimmer	

Items Not Listed Are Normally Available At Local Distributors.

COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.
	FIXED DISK/FLOPPY DISK ADAPTER	
L1	RF Choke	
L2	RF Choke	
L3	RF Choke	

ITEM No.	FUNCTION	MFGR. PART No.
	FLOPPY DISK DRIVE	
L1	Peaking	
L2	Peaking	
L3	Peaking	
L4	Peaking	
L5	Filter	
L6	RF Choke	
L7	RF Choke	
L8	RF Choke	

CONTROLS (All wattages 1/2 watt, or less, unless listed)

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
	FLOPPY DISK DRIVE			
VR1	Balance	10K		
VR2	Balance	10K		
VR3	Balance	50K		

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
	FIXED DISK/FLOPPY DISK ADAPTER		
DL1	Delay Line		
Y1	Oscillator		24MHz
Y2	Oscillator		10MHz
	FLOPPY DISK DRIVE		
LED1	LED		Activity, Red
M1	Sensor		Track 00
M2	Sensor		Diskette Detector
M3	Solenoid		Head Loading
M4	Motor		Head Position
M5	Sensor		Index
M6	Sensor		Write Protect
M7	Head		Read/Write/Erase
X1	Crystal		4MHz

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
	FLOPPY DISK DRIVE			
R11	13K 1% 1/8W Carbon Film			
R12	62.0 1% 1/8W Carbon Film			
R27	300 2% 1.2W Carbon Film		HW130	
R28	470 2% 1/2W Carbon Film		HW147	22-2237
R29	470 2% 1/2W Carbon Film		HW147	22-2237
R37	150 1% 1/8W Carbon Film			
RN1	Resistor Network	(12)		
RN2	Resistor Network	(5)		
RN3	Resistor Network	(5)		
RN4	Resistor Network	(1)		
RN5	Resistor Network	(5)		
TM	Resistor Network	(10)		
	FLOPPY DISK CONTROLLER			
R13	8250 1% 1/8W Carbon Film			
R14	6810 1% 1/8W Carbon Film			
R17	475 1% 1/8W Carbon Film			
R18	1210 1% 1/8W Carbon Film			
R20	1M 1% 1/8W Carbon Film			
R21	1M 1% 1/8W Carbon Film			
R22	432 1% 1/8W Carbon Film			
R34	17.8K 1% 1/8W Carbon Film			
R35	4020 1% 1/8W Carbon Film			
	3980 1% 1/8W Carbon Film			
R37	3480 1% 1/8W Carbon Film			
R38	1740 1% 1/8W Carbon Film			
R39	4750 1% 1/8W Carbon Film			
R40	5620 1% 1/8W Carbon Film			
R41	301 1% 1/8W Carbon Film			
R45	110K 1% 1/8W Carbon Film			
R46	174K 1% 1/8W Carbon Film			
R48	12.7K 1% 1/8W Carbon Film			
R49	17.8K 1% 1/8W Carbon Film			
R50	6190 1% 1/8W Carbon Film			
R51	105K 1% 1/8W Carbon Film			
R52	17.8K 1% 1/8W Carbon Film			
	12.8K 1% 1/8W Carbon Film			
R54	17.8K 1% 1/8W Carbon Film			
R55	17.8K 1% 1/8W Carbon Film			
R69	3010 1% 1/8W Carbon Film			
R70	2000 1% 1/8W Carbon Film			
Z1	Resistor Network	(7)		
Z2	Resistor Network	(8)		
Z3	Resistor Network	(9)		
Z4	Resistor Network	(7)		
Z5	Resistor Network	(10)		
Z6	Resistor Network	(11)		
	FLOPPY DISK DRIVE (ALTERNATE)			
RN1	Resistor Network	(1)		
RN2	Resistor Network	(2)		
RN3	Resistor Network	(3)		
RN4	Resistor Network	(3)		
RN5	Resistor Network	(4)		
RN6	Resistor Network	(5)		
RN7	Resistor Network	(4)		
RN8	Resistor Network	(5)		
TM	Resistor Network	(6)		

(1) 150 5% x 4
(2) 47K 5% x 4
(3) 680, 1000, 1200, 4700 5% x 1 each
(4) 4700 5% x 3
(5) 4700 5% x 4
(6) 150 5% x 3

(7) 1500 x 7
(8) 220 x 4
(9) 330 x 6; 220 x 6
(10) 150 x 7
(11) 220 x 5
(12) 10K 5% x 5

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
U26	SN74LS174N	NTE74LS174	ECG74LS174	SK74LS174	HE-443-879	
U27	AM26S02PC					
U28	SN74S113N	NTE74S113	ECG74S113			
U29	WD2293A-PE					
U30	D765AC					
U31	8049HC150					
U32	SN74LS373N	NTE74LS373	ECG74LS373	SK74LS373	HE-443-867	
U33	SN7406N	NTE7406	ECG7406	SK7406	HE-443-698	
U34	SN74LS373N	NTE74LS373	ECG74LS373	SK74LS373	HE-443-867	
U35	HAL16LBACN					
U36	74LS155NA	NTE74LS155	ECG74LS155	SK74LS155	HE-443-782	
U37	74F74PC					
U38	SN74LS221N	NTE74LS221	ECG74LS221	SK74LS221		
U39	WD2293-PE					
U40	TL081CP	NTE857M	ECG857M			
U41	74LS00NA	NTE74LS00	ECG74LS00	SK74LS00	HE-443-728	
U42	MC3487N				HE-443-1167	
U43	74LS04NA	NTE74LS04	ECG74LS04	SK74LS04	HE-443-755	
U44	SN74LS175N	NTE74LS175	ECG74LS175	SK74LS175	HE-443-752	
U45	74LS245NA	NTE74LS245	ECG74LS245	SK74LS245	HE-443-885	
U46	SN74LS367AN	NTE74LS367	ECG74LS367	SK74LS367	HE-443-857	
U47	74F00PC					
U48	74LS00NA	NTE74LS00	ECG74LS00	SK74LS00	HE-443-728	
U49	74LS112PC	NTE74LS112A	ECG74LS112A			
U50	SN74S196N					
U51	SN74S124N	NTE74S124	ECG74S124			
U52	74LS393NA	NTE74LS393	ECG74LS393	SK74LS393	HE-443-973	
U53,4	MB8128-15					
U55	74LS245NA	NTE74LS245	ECG74LS245	SK74LS245	HE-443-885	
U56	SN74LS367AN	NTE74LS367	ECG74LS367	SK74LS367	HE-443-857	

PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
FIXED DISK-FLOPPY DISKETTE ADAPTER						
CR1 THRU CR10	1N4148	NTE519	ECG519	SK3100/519	103-131	
CR11,2,3		NTE519	ECG519	SK3100/519	103-131	
CR14,5						USED IN SOME VERSIONS.
CR16,7	1N4148	NTE519	ECG519	SK3100/519	103-131	
Q1 THRU Q6	2N3906	NTE159	ECG159	SK3466/159	121-Z9003	
U1	74S74PC	NTE74S74	ECG74S74	SK74S74	HE-443-900	
U2	74F00PC					
U3	SN74S113N	NTE74S113	ECG74S113			
U4	AM26S02PC					
U5	UA9638CP					
U6	7438PC	NTE7438	ECG7438	SK7438	HE-443-77	
U7	TL081CP	NTE857M	ECG857M			
U8	74F74PC					
U9	7438PC	NTE7438	ECG7438	SK7438	HE-443-77	
U10	74S174NA	NTE74S174	ECG74S174	SK74S174	HE-443-1053	
U11	SN74LS109AN	NTE74LS109A	ECG74LS109A	SK74LS109		
U12	SN74S153N	NTE74S153	ECG74S153		HE-443-935	
U13	UA9637ACP					
U14	7438PC	NTE7438	ECG7438	SK7438	HE-443-77	
U15	MPQ6700					
U16	SN74LS629N	NTE74LS629	ECG74LS629			
U17	MPQ6700					
U18	WD1014-CL					
U19	HAL16LBACN					
U20	SN74LS14N	NTE74LS14	ECG74LS14	SK74LS14	HE-443-872	
U21	SN7406N	NTE7406	ECG7406	SK7406	HE-443-698	
U22	SN74LS14N	NTE74LS14	ECG74LS14	SK74LS14	HE-443-872	
U23	74S74PC	NTE74S74	ECG74S74	SK74S74	HE-443-900	
U24	WD1010-PL					
U25	SN74LS373N	NTE74LS373	ECG74LS373	SK74LS373	HE-443-867	

TROUBLESHOOTING (Continued)

and a logic High with the Head off Track 00. If the readings are not correct, check IC U48. If the readings are correct, check for a logic High with pulses at pin 6 of IC U59 when the Head is on Track 00 and a logic Low when the Head is off Track 00. If the readings are not correct, check IC U59. If the readings are correct, check the Floppy Disk Controller IC (U30).

INDEX DETECTOR

To verify that the Index Detector circuits are working properly, insert a diskette into the Drive and close the door, then type in and run the Basic program listed under "Continuous Operation of Disk Drive" to keep the drive running. Check for pulses at pin 17 of Floppy Disk Controller IC (U30) on the Disk Interface Board.

If pulses are missing at pin 17 of IC U30, check for pulses at pin 5 of IC U22. If pulses are present, check IC U22. If pulses are missing, check for pulses at pin 11 of IC IC6 on the Disk Drive Board. If pulses are present, check pin 8 of Connector J1 for good connections and check the Drive cable. If pulses are missing, check for pulses at pin 12 of IC IC6. If pulses are present, check IC IC6. If pulses are missing, check for pulses at TP3. If pulses are present at TP3, check the Disk Controller IC (IC4). If pulses are missing, check for pulses at pin A11 of Connector J3. If pulses are present, check Transistor DT16, Capacitor C25 and Resistors R47, R48, and R50. If pulses are missing, check the Index Sensor (M5) and check pins A11 and B13 of Connector J3 for good connections.

DRIVE MOTOR

Check for 12V at pin 1 and 5V at pin 4 of Connector J2. If either voltage is missing, check Connector J2 and cable for good connections. If voltages are correct, type in and run the Basic program listed under "Continuous Operation of Disk Drive". While program is running, check for a logic Low at pin 10 and a logic High at pin 15 of Flip/Flop IC (U26) on the Disk Interface Board. If the readings are not correct, check IC U26. If the readings are correct, check for a logic High at pin 12 of IC U22. If the reading is not correct, check IC U22. If the reading is correct, check for a logic High at pin 10 of IC U59. If the reading is not correct, check IC U59. If the reading is correct, check for a logic Low at pins 6 and 11 of IC U6. If the readings are not correct, check IC U6. If the readings are correct, check pins 10, 12, 14, and 16 of Connector J1 for good connections. If the connections check good, check for 5.0V at the Base of Switch Transistor DT14 on the Disk Drive Board. If the voltage is not correct, check the Disk Controller IC (IC4). If the voltage is correct, check for 4.9V at pin A6 of Connector J3. If the voltage is not correct, check Switch Transistors DT13 and DT14. If the voltage is correct, check pins A5, A6, A7, and B5 of Connector J3 for good connections. If the Connectors check good, check the Motor Control Board.

HEAD POSITION MOTOR

Head Position Motor (M4) not working. Type in and run the following Basic program. The program continuously moves the Drive Head back and forth.

```
 10 OUT 1014,128:OUT 1010,16:OUT 1010,20
 20 OUT 1013,7:S=INP(1012)
 30 OUT 1013,1:S=INP(1012)
 40 OUT T=1 TO 500:NEXT T
 50 OUT 1010,20
 60 OUT 1013,15:S=INP(1012)
 70 OUT 1013,1:S=INP(1012)
 80 OUT 1013,16:S=INP(1012)
 90 FOR T=1 TO 500:NEXT T
100 GOTO 10
```

While the program is running, check for pulses at pins 37, 38, and 39 of the Floppy Disk Controller IC (U30) on the Disk Interface Board. If pulses are missing, check IC U30. If pulses are present, check for pulses at pin 8 of IC's U14 and U21. If pulses are missing at IC U14, check IC U14. If pulses are missing at IC U21, check IC U21. If pulses are present at IC's U14 and U21, check pins 18 and 20 of Connector J1 for good connections. If the connections check good, check for pulses at pins 2 thru 5 of IC TA1 and pin 5 of IC HIC1 on the Disk Drive Board. If pulses are missing, check the Disk Controller IC (IC4). If pulses are present, check IC's TA1 and HIC1 and check pins A1, A2, A3, B1, B2, and B3 of Connector J3 for good connections and check the Head Position Motor (M4).

LOGIC CHART

FLOPPY DISK DRIVE   DRIVE A PROGRAM RUNNING

PIN NO.	IC IC1	PIN NO.	IC IC1	PIN NO.	IC IC1	IC IC2	IC IC3	IC IC4	PIN NO.	IC IC4	PIN NO.	IC IC4	IC IC5	IC IC6
1	P	21	0	41	L	L(2)	L(1)	L	21	L(1)	NO.	H	H	H
2	P	22	11.8	42	H	L(2)	L	L	22	H(1)	42	H	H	H
3	P	23	2.0	43	H	H(4)	H(1)	H	23	H(1)	43	H	H	L
4	H	24	2.0	44	P	H	L	L	24	L(7)	44	L(3)	H	L
5	*OV	25	5.3			L	P	P	25	L	45	H	H	L
6	H 11.8	26	4.9			H	H	L	26	H	46	L	L	H
7	Varies 0V-4V	27	3.5			L	L	H(1)	27	H	47	L	L	L
8	Varies 04-4V	28	3.5			P	P	P	28	H	48	L	H	H(1)
9	L	29	3.5			P	P	H(6)	29	L			L	H
10	11.0V	30	2.3			H	P	P	30	P			H(1)	L(1)
11	11.6V	31	2.3			H(5)	P	L(3)	31	L			H(1)	P
12	11.6	32	5.8			L(3)	P	L(2)	32	P			L	P
13	.2V	33	5.6			L(3)	P	H	33	P			H	P
14	0V	34	5.8			H	H	H	34	P			H	H
15	Varies 0-1.4V	35	5.7					P	35	H				
16	Varies 0-3V	36	0					P	36	H				
17	L	37	.8					L	37	P				
18	2.8	38	4.2					L	38	L(2)				
19	2.8	39	1.4					H	39	H				
20	L	40	.2					L(1)	40	H				

PIN NO.	IC HIC1	IC TA1
1	H	H
2	H	L(1)
3	L	H(1)
4	H	L(1)
5	L(7)	L(1)
6		H
7		L
8		L
9		H
10		*
11		L
12		H(1)
13		L(1)
14		L(1)
15		H(1)
16		P

TROUBLESHOOTING (Continued)

that the Oscillators are working properly, see the "Oscillators and Dividers" section. If the Oscillators and Connectors check good, type in and run the following Basic program:

WARNING: Do not use diskettes that have important data on them. This program will write over and destroy the information. Use a blank diskette when running this program.

```
 10 CLS
 20 OUT 1014,128:OUT 1010,16:OUT 1010,20
 30 S=INP(1012)
 40 OUT 1013,77:S=INP(1012)
 50 OUT 1013,Y:S=INP(1012)
 60 OUT 1013,1:S=INP(1012)
 70 OUT 1013,12:S=INP(1012)
 80 OUT 1013,12:S=INP(1012)
 90 OUT 1013,0:S=INP(1012)
100 S=INP(1013):S=INP(1012)
110 PRINT INP(1013) AND 2:S=INP(1012)
120 FOR X=1 TO 5
130 S=INP(1013):S=INP(1012)
140 NEXT X:LOCATE 1,1
150 IF Y=1 THEN Y=5 ELSE Y=1
160 GOTO 20
```

NOTE: The above program will not write to diskette if diskette index detector circuits are not working. Verify index detector circuits are working by checking for pulses at pin 17 of Floppy Disk Controller IC (U30) while above program is running with a diskette inserted in the Drive. If pulses are missing, refer to the "Index Detector" section of this Troubleshooting guide.

While program is running, insert a diskette that is not write protected into the Drive and check for the number 0 on Monitor screen, then insert a write protected diskette into Drive and check for the number 2 on Monitor screen. If numbers are not correct, refer to the "Write Protect Does Not Function" section of this Troubleshooting guide.

While the program is running, check for pulses at pins 25 and 30 of IC U30 on the Interface Board. If pulses are missing, check IC U30. If pulses are present, check for pulses at pin 9 of IC U39. If pulses are missing, check IC U39. If pulses are present, check for a logic High at pin 13 and pulses at pin 11 of IC U14. If pin 13 does not read logic High, check IC U59. If the reading is correct on pin 13 and not correct on pin 11 of IC U14, check IC U14. If pulses are present at pin 11 of IC U14, check for pulses at pin 13 of IC IC3 on the Disk Drive Board. If pulses are missing, check IC IC3. If pulses are present, check the voltages and components associated with pins 1 thru 44 of the Read/Write Amp IC (IC1). Also check Connector J4 for good connections and check the Head windings for continuity.

WRITE PROTECT DOES NOT FUNCTION

To verify the operation of the Write Protect Circuits, use the program and instructions given under the "Will Not Write" section of this Troubleshooting guide. If the write protect circuit is not working properly, insert a BLANK write protected diskette into the Drive and close the door. Check for a logic High at pin A9 of Connector J3. If the reading is not correct, check pins A8 and A9 of Connector J3 for good connections and check the Write Protect Sensor (M6) and the Resistor from pins 3 to 4 of Resistor Pack RN4. If the reading is correct at pin A9 of Connector J3, type in and run the program listed under the "Will Not Write" section. While the program is running, check for a logic High at pin 1 and logic Low at pin 3 of IC2. If the reading is not correct at pin 1, check the Disk Controller IC (IC4). If the reading is correct at pin 1 and not correct at pin 3, check IC2. If the reading is correct at pin 3 of IC2, check for a logic High at pin 2 of IC U22 on the Interface Board. If the reading is not correct, check IC U22 and check pin 24 of Connector J1 for good connections. If the reading is correct at pin 2 of IC U22, check the Floppy Disk Controller IC (U30).

TRACK 00 DETECTOR

Disk Drive Head will not move back to track 00 or bangs against the Track 00 stop. Type in and run the following Basic program to check the Track 00 Detector circuits. The program will step the Head back to Track 00 and display the number 16 on the Monitor screen to indicate the Head is on Track 00. If the Head is manually pushed off Track 00 the number 16 should change to the number 0.

```
 10 OUT 1014,128:OUT 1010,16:OUT 1010,20
 20 OUT 1013,7:S=INP(1012)
 30 OUT 1013,1:S=INP(1012)
 40 FOR T=1 TO 500:NEXT T
 50 OUT 1014,128:OUT 1010,20
 60 S=INP(1012)
 70 OUT 1013,4:S=INP(1012)
 80 OUT 1013,2:S=INP(1012)
 90 CLS:PRINT INP(1013) AND 16:S=INP(1012)
100 GOTO 40
```

If the number on the Monitor screen is not correct or does not change when the Head is moved On and Off of Track 00, make the following checks while the above program is running.

Check for a logic High when the Head is on Track 00 and logic Low when the Head is Off Track 00 at TP5 on the Disk Drive Board. If the readings are not correct, check pins A12, A13, B12, and B13 of Connector J3 for good connections and check the Track 00 Sensor (M1) and Transistors Q2 and DT12. If the readings are correct at TP5, check for a logic High at pin 12 of IC2 when the Head is on Track 00 and a logic Low with the Head off Track 00. If the readings are not correct, check the Disk Controller IC (IC4). If the readings are correct, check for a logic Low at pin 11 of IC2 when the Head is on Track 00 and logic High when the Head is off Track 00. If the readings are not correct, check IC2. If the readings are correct, check for a logic High at pin 4 of IC U22 on the Interface Board when the Head is on Track 00 and a logic Low when the Head is off Track 00. If the readings are not correct, check IC U22. If the readings are correct, check for a logic Low with pulses at pin 6 of IC U48 with the Head on Track 00

TROUBLESHOOTING

TEST SETUP

If Disk Drive A is defective, type in any alignment or test programs needed to check Drive A and save them to the Fixed Disk Drive C. Then load the programs from Drive C as needed to check Disk Drive A.

If Disk Drive Adapter Board is defective the Basic programs that are listed in this Troubleshooting Guide will run in the ROM Basic that is built into Computer, see "BASIC" section of "General Operating Instructions" for instructions on getting ROM Basic.

WARNING: It is possible for a defective Disk Drive to write on or erase information on a diskette, even if the diskette is write protected. Check the Disk Drive by first using a diskette that has programs that have been backed up on another diskette. Do not leave the alignment diskette in the drive while checking voltages and waveforms unless specified in the alignment procedures. The test equipment may cause the Disk Drive circuits to erase sections of the alignment diskette even if the diskette is write protected.

CONTINUOUS OPERATION OF DISK DRIVE

The following Basic program can be used to keep Drive A running continuously:

```
10 OUT 1014,128:OUT 1010,20:GOTO 10
```

OSCILLATORS AND DIVIDERS

INTERFACE BOARD

Check the 24MHz Osc (Y1) by checking for a 24MHz waveform at pin 8 of IC U47. If the waveform is missing, check IC U47 and Oscillator Y1. Check the 24MHz Dividers by checking for an 8.0MHz waveform at pin 5 of Flip/Flop IC (U37) and a 4.8MHz waveform at pin 2 of Flip/Flop IC (U50). If the 8.0MHz waveform is missing, check IC's U37, U47, U49, and U56. If the 8.0MHz waveform is present and the 4.8MHz waveform is missing, check IC U50.

Voltage Controlled Oscillator IC (U16) is a dual-voltage controlled oscillator. When a 360 KB diskette is being used in Drive A, the VCO SEL signal at pin 6 of IC U16 is set Low to enable a clock waveform of about 2.4MHz at pin 7 of IC U16. When a 1.2 MB diskette is being used, the VCO SEL signal is set High to enable a clock waveform of about 2.0MHz at pin 10 of IC U16. If the VCO SEL signal at pin 6 of IC U16 does not change when different capacity diskettes are used, check Controller IC U29, IC U48, and IC U16. If the frequencies are not correct, check the voltages and components associated with IC's U7 and U16.

DISK DRIVE BOARD

Check for a 4.0MHz waveform at pin 15 of the Disk Controller IC (IC4). If the waveform is missing, check Crystal X1, Capacitors C22 and C23, Resistor R41 and IC4.

WILL NOT READ

Check Connector J1 on the Interface Board and Disk Drive Board for good connections. Verify that the Oscillators are working properly, see the "Oscillators and Dividers" section. If the oscillators check good, type in and run the following Basic Program:

```
10 OUT 1014,128:OUT 1010,16:OUT 1010,20
20 OUT 1013,74:S=INP(1012)
30 OUT 1013,Y:S=INP(1012)
40 FOR X=1 TO 7
50 S=INP(1013):S=INP(1012)
60 NEXT X
70 IF Y=1 THEN Y=5 ELSE Y=1
80 GOTO 10
```

The program keeps Drive A running in read mode. Insert a diskette with data on it in the Drive and close the door. While the program is running, check for a logic High at pin 24 of Connector J1. If the reading is not correct, check for a logic Low at pin 25 of Floppy/Disk Controller IC (U30) on the Disk Interface Board. If the reading is correct at pin 25, check IC U42. If the reading is not correct at pin 25, check IC U30.

If the reading is correct at pin 24 of Connector J1, check the waveform at pin 9 of IC2 on the Disk Drive Board. There should be a noticeable change in the waveform as the Drive door is opened and closed. If there is no change, check the voltages and components associated with the Read/Write Amp IC (IC1), check Connector J4 for good connections, and check the Head windings for continuity. If the waveform checks good at pin 9 of IC2, check for a logic High at pin 10 and pulses at pin 8 of IC2. If pulses are missing at pin 8 and pin 10 reads logic High, check IC2. If pin 10 does not read logic High, check for a logic High at pins 1 and 2 of IC5. If the readings are correct at pins 1 and 2, check IC5 and Transistor DT1. If the reading is not correct at pin 2 of IC5, check for a logic Low at pin 4 of IC6. If the reading is correct at pin 4, check IC6. If the reading is not correct at pin 4 of IC6 or pin 1 of IC5, check the Disk Controller IC (IC4).

If pulses are present at pin 8 of IC2, check for pulses at pin 10 of IC U22 on the Interface Board. If pulses are missing, check IC U22. If pulses are present, check for pulses at pin 4, a logic High at pins 16 and 17 and a logic Low at pin 18 of Controller IC (U29). If any of the readings are not correct, check IC U29. If the readings are correct, check for pulses at pins 12 and 13 of IC U38. If pulses are missing, check IC's U27 and U38 and Transistors Q1 thru Q5. If pulses are present, check for pulses at pin 4 of the Floppy Disk Controller IC (U30). If pulses are missing, check IC U58. If pulses are present, check IC U30.

WILL NOT WRITE

Check Connector J1 on the Interface Board and Disk Drive Board for good connections. Verify

LOGIC CHART (Continued)

FLOPPY DISK ADAPTER (PROGRAM A RUNNING)

PIN NO.	IC U1	IC U2	IC U3	IC U4	IC U5	IC U6	IC U7	IC U8	IC U9	IC U10	IC U11	IC U12	IC U14	IC U15
1	P	*	P	P	*	H	-11.9	P	L	H	P	L	L	3.2
2	H	*	P	P	P	H	2.5	H	H	P	P	L	H	1.3
3	P	L	P	H	P	L	2.5	P	H	P	P	H	*	.7
4	H	*	H	P	L	H	-12.0	H	L	H	P	H	H	0
5	P	*	P	H	P	H	-11.9	P	L	H	L	P	L(8)	4.4
6	P	L	P	P	P	L	2.5	P	H	L	H	L	H(6)	3.8
7	L	L	L	P	P	L	11.9	L	L	L	P	P	L	.9
8	P	P	P	L	P	*	0	P	H	L	L	L	H(1)	1.3
9	P	P	P	P		L		P	L	P	H	P	L(1)	3.8
10	H	P	P	P		L		H	P	H	L	P	P	4.4
11	P	L	L	H		L		P	L	H	H	P	P	0
12	H	*	H	P		H		P	L	H	L	L	P	.6
13	P	*	P	H		H		H	L	H	H	L	H	1.3
14	H	H	H	P		H		H	H	H	H	H	H	1.3
15				P						H	L	L		
16				H						H	H	H		

PIN NO.	IC U16	IC U18	PIN NO.	IC U18	IC U19	IC U20	IC U21	IC U22	IC U23	IC U24	PIN NO.	IC U24	IC U25	IC U26
1	2.5	L	21	H	P	P	H	H	P	H	21	L	P	H
2	2.5	H	22	H	P	P	L	L	H	H	22	H	P	L
3	2.7	P	23	H	P	H	L	H(5)	P	L	23	H	H	P
4	2.3	P	24	P	P	L	H	L(3)	H	*	24	L	H	P
5	2.3	P	25	P	P	H	H	P	P	H	25	P	P	H
6	.1	P	26	P	H	L	L	P	P	P	26	H	P	*
7	2.2	P	27	P	L	L	L	L	L	P	27	L	H	H
8	0	P	28	H	H	L	P	L	P	P	28	H	L	L
9	0	P	29	L	H	H	P	H	P	P	29	P	P	P
10	0	P	30	L	L	H	H	P	H	P	30	L	L	L
11	4.6	P	31	L	H	L	L	P	P	P	31	L	P	P
12	2.3	H	32	L	L	H	H	H	H	P	32	H	P	H
13	1.7	P	33	L	H	L	L	L	P	P	33	L	H	P
14	2.6	P	34	H	H	H	H	H	H	P	34	H	L	P
15	5.0	P	35	L	H					P	35	H	P	H
16	5.0	P	36	L	H					P	36	L	P	H
17		H	37	L	L					P	37	P	H	
18		H	38	H	H					P	38	L	L	
19		H	39	L	P					P	39	P	P	
20		L	40	H	H					L	40	H	H	

LOGIC CHART (Continued)

FLOPPY DISK ADAPTER (PROGRAM A RUNNING)

PIN NO.	IC U27	IC U28	IC U29	IC U30	PIN NO.	IC U30	IC U31	PIN NO.	IC U31	IC U32	IC U33	IC U34	IC U35	IC U36
1	*	P	P	L	21	P	L	21	H	H	*	H	P	P
2	*	H	P	P	22	P	P	22	H	P	L	P	P	P
3	H	H	P	P	23	P	P	23	H	P	P	P	P	P
4	P	H	P	P	24	P	H	24	H	P	P	L	P	P
5	H	P	P	P	25	P	H	25	H	H	P	P	L	P
6	P	P	P	P	26	H	H	26	H	P	P	P	P	H
7	P	L	H	P	27	L(8)	L	27	L	P	L	L	L	H
8	L	P	H	P	28	L(1)	H	28	H	P	L	L	H	L
9	P	P	P	P	29	L(1)	H	29	H	P	*	P	H	H
10	P	P	L	P	30	P	H	30	H	L	L	L	L	P
11	H	L	P	P	31	P	P	31	H	P	H	H	P	H
12	P	H	H	P	32	P	P	32	H	P	H	P	P	P
13	H	P	P	P	33	L(3)	P	33	H	P	L	H	P	P
14	P	H	L	P	34	L	P	34	H	P	H	H	P	P
15	P		L	P	35	H	P	35	L	P		P	P	L
16	H		H	P	36	H	P	36	H	*		P	P	H
17			L	P	37	P	P	37	L	P		L	P	
18			H	P	38	P	P	38	L	P		L	L	
19			P	P	39	L(1)	P	39	L	*		P	H	
20			H	L	40	H	L	40	H	H		H	H	

PIN NO.	IC U37	IC U38	IC U39	IC U41	IC U42	IC U43	IC U44	IC U45	IC U46	IC U47	IC U48	IC U49	IC U50	IC U52
1	P	L	P	P	H	H	H	P	L	P	P	P	H	L
2	H	P	P	P	P	L	L	P	P	H	P	P	P	L
3	P	H	P	P	*	H	H	P	P	P	P	P	L	L
4	H	P	H	L	L	H	P	P	P	H	L(1)	H	L	L
5	P	P	H	H	*	H	P	P	P	P	L(3)	P	P	L
6	P	P	P	H	P	L	H	P	P	P	H(5)	P	P	L
7	L	P	P	L	H	L	L	P	P	L	L	P	L	L
8	P	L	H	P	L	L	L	P	L	P	H	L	P	L
9	P	L	P	P	H	*	H	P	P	P	L	P	P	L
10	H	P	L	H	H	P	L	L	P	H	L	H	L	L
11	P	H	P	H	L	P	H	P	P	H	P	P	L	L
12	P	P	P	L	H	L	P	P	P	L	P	P	P	L
13	H	P	L	H	P	H	P	P	P	L	H	P	H	L
14	H	P	P	H	P	H	H	P	P	H	H	H	H	H
15		L	P		P		L	P	L			H		
16		H	P		H		H	P	H			H		
17			P					P						
18			P					P						
19			P					P						
20			H					H						

ALIGNMENT (Continued)

2 pulses

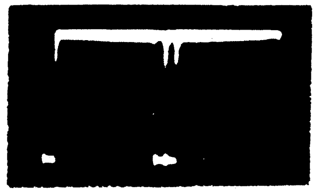
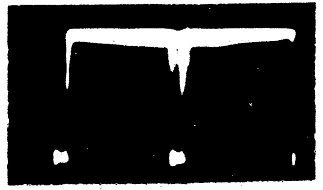


Figure 5

1 pulse



MINIMUM Jitter
Figure 6

INDEX SENSOR ADJUSTMENT

Connect the channel A input of a dual-trace scope to TP2A, channel B input to TP3 (index pulse) and the scope ground to TPG. Set the scope display to channel A with the voltage range set to 20mV and the sweep time set to 50us. Set the channel B input to noninverting mode and trigger the scope on channel B with the trigger set to positive slope.

Insert the Alignment Diskette in the Disk Drive and close the door. Turn On the Disk Drive, select side 0 and set the head to track 02. Confirm that the leading edge of the burst occurs 165us ±165us after the leading edge of the index pulse, see Figure 3. If the index sensor is out of adjustment, loosen the index sensor retaining screw on the top of the Disk Drive and adjust the index sensor for 165us ±165us, see Disk Drive Mechanical, Top View Photo. If side 0 checks good, select side 1 and repeat the above procedure to check Head 1.

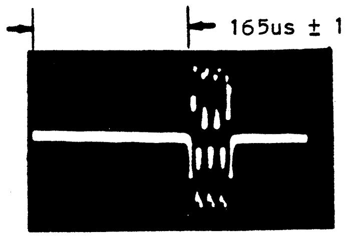


Figure 3

ALIGNMENT

EQUIPMENT REQUIRED

A test program or a Disk Drive Tester is required which will turn On the Disk Drive, select side 0 or 1 and step the head to the track specified in the alignment procedures. Use a Dysan Analog Alignment Diskette 206/34 when an Alignment Diskette is specified in the alignment procedures. NOTE: This alignment diskette has only alignment patterns on it and does not contain any alignment programs.

DISK TRACK PROGRAM

The following Basic programs can be used to step the Disk Drive head to the track specified by the user. To stop the program, press the Ctrl and Break keys.

Operates Drive A

```
 10 CLS
 20 OUT 1014,128:OUT 1010, 16:OUT 1010,20
 30 OUT 1013,7:S=INP(1012)
 40 OUT 1013,1:S=INP(1012)
 50 INPUT "ENTER TRACK NUMBER ";TR
 60 IF TR>80 THEN 50
 70 OUT 1010,20
 80 OUT 1013,15:S=INP(1012)
 90 OUT 1013,1:S=INP(1012)
100 OUT 1013,TR:S=INP(1012)
110 FOR T=1 TO 400:NEXT T
120 PRINT"PRESS ANY KEY TO STOP"
130 A$=INKEY$:OUT 1010,20:IF A$="" THEN 130
    ELSE 50
```

SPINDLE SPEED ADJUSTMENT

If a Disk Drive Tester which provides a readout of the speed in rpm is being used, adjust the Spindle Speed Control VR1 on the Motor Control Board for a speed of 360 rpm.

If a Disk Drive Tester is not available, center and paste the strobe pattern in Figure 1 on the Drive Motor on the bottom of the Disk Drive. Insert a diskette into the Drive and close the door. Type in and run the program listed under "Continous Operation of Disk Drive" to keep the Disk Drive running. Use 60-cycle fluorescent lighting to view the strobe pattern. Adjust the Spindle Speed Control VR1 on the Motor Control Board until the strobe pattern appears to stand still.

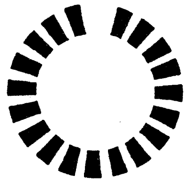


Figure 1

RADIAL HEAD ALIGNMENT

Connect channel A input of a dual-trace scope to TP2A, channel B to TP2B, and the external trigger input to TP3. Connect the scope ground to TPG. Set the scope to add mode with one channel inverted, the sweep time to 20mSec and the voltage range to .2V. Set both scope inputs to AC. Insert the Alignment Diskette into the Disk Drive and close the door. Turn On the Disk Drive and step the head to Track 32, Side 0. The cats-eye pattern shown in Figure 2 should be displayed on the scope.

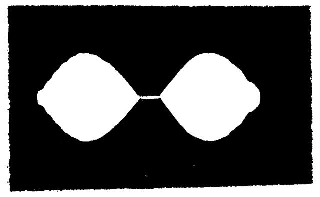


Figure 2

The amplitude of the two lobes displayed must be within 70% of each other. If the lobes are out of tolerance, loosen two screws holding Head Position Motor (M4). Adjust Motor until the two lobes are equal in amplitude and tighten Motor mount screws. Check the adjustment by stepping the head to Track 79 and back to Track 32, then to Track 00 and back to Track 32, checking the lobes each time the head is on Track 32. Check the Track 00 Stop and Detector adjustments after performing the Radial Head Alignment. If Disk Drive is a double sided drive, select side 1 and check Radial alignment of Head 1 using the above procedures.

TRACK 00 SENSOR AND STOP ADJUSTMENT

Check the Radial Head Alignment before performing the Track 00 Sensor and Stop Adjustments. Set the head to Track 00 and verify that it is on Track 00 by inserting the Alignment Diskette in the Drive and checking for a 125kHz sine wave at TP2A with a scope. Set the scope sweep time to 10uSec and the Voltage range to .5V. If the head is not on Track 00, perform the Radial Head Alignment.

To adjust the Track 00 Sensor, connect a voltmeter to TP5. Set the head to Track 2 and check for 5.0V. Then set the head to Track 3 and check for 0V. If the voltages are not correct, set the head to Track 2. Loosen the Track 00 Sensor screw. Adjust the Sensor for a voltage of 0V, then adjust it until the voltage jumps to 5.0V and tighten the screw. Recheck the Sensor Adjustment.

To adjust the Track 00 stop, set the head to Track 00. Loosen the Track 00 stop screw. Adjust the stop for a gap of .01 inch between the stop and the Head stop post and tighten the stop screw.

READ CIRCUIT ADJUSTMENT

Connect the input of a scope to pin 38 of IC1. Set the sweep time to 1uSec and voltage range to 2V/cm. Insert the Alignment diskette in the Drive. Turn the Drive On and set the head to Track 00 to read the 125kHz pattern. Turn the Phase Adjust Control (VR3) fully counterclockwise. Set the scope trigger control so the second pulse on the scope screen appears to be two pulses out of phase, see Figure 5. Adjust VR3 until the pulses appear to be one pulse with MINIMUM jitter, see Figure 6.

LOGIC CHART (Continued)

FLOPPY DISK ADAPTER (PROGRAM A RUNNING)

PIN NO.	IC U53	PIN NO.	IC U53	IC U54	PIN NO.	IC U54	IC U55	IC U56	IC U57	IC U58	IC U59	IC U60	IC U61	IC U62	IC U63
1	L	21	H	L	21	H	P	L	L	H	P	H	P	L	P
2	L	22	L	L	22	L	*	P	L	H	P	H	P	L	P
3	L	23	L	L	23	L	*	P	H	H	P	P	P	L	P
4	L	24	H	L	24	H	*	P	H	P	P	P	P	L	P
5	L			L			*	P	L	P	H(5)	P	P	L	P
6	L			L			*	*	H	P	L(3)	P	P	L	P
7	L			L			*	H	*	L	L	L	P	L	P
8	L			L			*	L	L	P	P	P	P	L	P
9	P			*			*	P	P	P	P	*	P	L	P
10	P			*			L	P	P	P	H	*	L	L	L
11	P			*			P	P	P	P	L	P	P	H	*
12	L			L			P	P	H	P	P	P	P	L	*
13	P			P			P	P	P	P	P	*	P	L	*
14	P			P			P	P	P	H	H	H	P	H	*
15	P			P			P	L	P				P		*
16	P			P			P	H	H				P		*
17	P			P			P						P		*
18	L			L			P						P		*
19	H			H			H						P		H
20	H			H			H						H		H

LOGIC CHART (Continued)

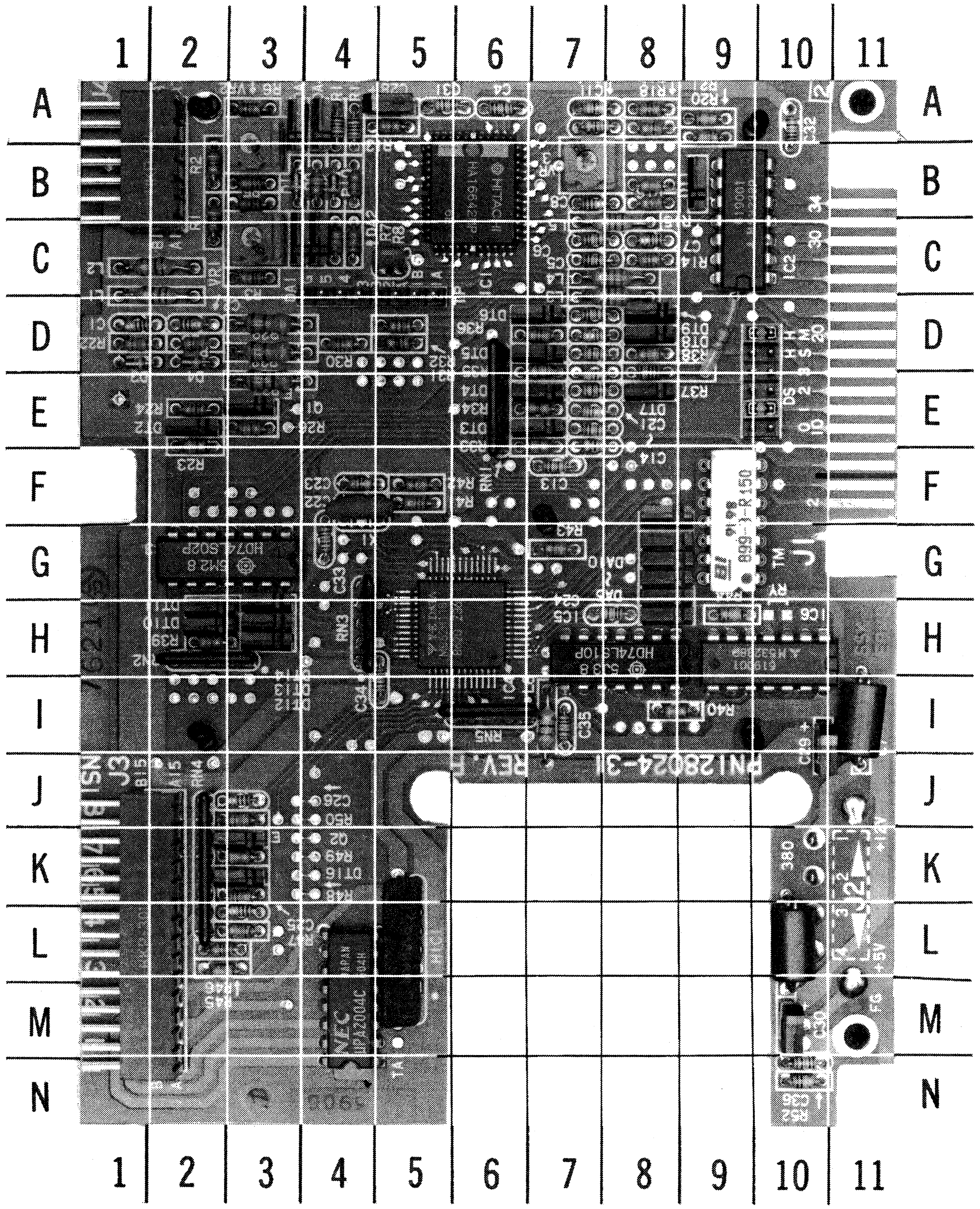
FIXED DISK ADAPTER (PROGRAM C RUNNING)

PIN NO.	IC U1	IC U2	IC U3	IC U4	IC U5	IC U6	IC U8	IC U9	IC U10	IC U11	IC U12	IC U13	IC U14	IC U17
1	P	*	P	P	H	L	L	L	H	P	L	5.0	L	3.2
2	H	*	P	P	P	H	H	H	P	P	P	.2	H	1.6
3	P	L	P	H	P	H	H	H	P	P	H	1.5	*	.9
4	H	*	H	P	L	H	P	P	P	P	H	0	H	0
5	P	*	P	H	P	L	P	P	P	P	P	2.2	L	4.1
6	P	L	P	P	P	H	P	P	P	P	L	1.4	H	3.4
7	L	L	L	P	P	L	L	L	P	P	P	2.3	L	2.3
8	P	P	P	L	P	*	P	P	L	L	L	2.3	H	3.4
9	P	P	P	P		L	P	P	P	P	P		L	3.4
10	H	P	P	P		L	H	P	P	P	P		L	4.1
11	P	L	L	H		H	P	H	P	H	P		H	0
12	H	*	H	P		L	P	L	P	P	P		L	.9
13	P	*	P	H		H	H	L	P	H	P		H	1.6
14	H	H	H	P		H	H	H	P	H	H		H	1.6
15				P					P	P	L			
16				H					H	H	H			

PIN NO.	IC U18	PIN NO.	IC U18	IC U19	IC U20	IC U21	IC U22	IC U23	IC U24	PIN NO.	IC U24	IC U25	IC U26	IC U27
1	L	21	H	P	P	H	H	P	P	21	P	H	H	*
2	H	22	P	P	P	L	L	H	P	22	P	P	L	*
3	P	23	P	P	H	L(1)	H	P	P	23	P	H	P	H
4	P	24	P	P	L	H(1)	L	H	*	24	P	H	P	P
5	P	25	P	P	H	L(1)	H	P	H	25	P	P	H	H
6	P	26	P	P	L	L(1)	L	P	P	26	H(1)	P	*	P
7	P	27	P	P	L	L	L	L	P	27	L(1)	H	H	P
8	P	28	P	P	L	H	L	P	P	28	H	L	L	L
9	P	29	P	P	H	L	H	P	P	29	P	P	H	H
10	P	30	P	L	H	H(1)	L	H	P	30	L	L	L	L
11	P	31	P	P	L	L(1)	H	P	P	31	L(1)	H	P	H
12	P	32	P	P	H(1)	H	H	H	P	32	H(1)	P	H	L
13	P	33	P	P	L(1)	L	L	P	P	33	L	P	P	H
14	P	34	H	P	H	H	H	H	P	34	P	H(1)	P	*
15	P	35	P	P					P	35	P	P	L	*
16	P	36	L(1)	P					P	36	P	P	H	H
17	P	37	L(1)	L					P	37	P	H(1)		
18	P	38	H(1)	P					P	38	P	L		
19	H	39	L	P					P	39	P	P		
20	L	40	H	H					L	40	H	H		

DISK DRIVE GridTrace LOCATION GUIDE

C1	D-1
C2	D-2
C3	C-5
C4	A-6
C5	C-7
C6	C-7
C7	C-8
C8	B-7
C11	A-7
C12	A-7
C13	F-7
C14	E-7
C15	E-7
C16	E-7
C17	E-7
C18	E-7
C19	D-7
C20	D-7
C21	D-7
C22	G-4
C23	F-4
C24	H-8
C24	L-3
C25	L-3
C26	J-3
C28	A-5
C29	I-10
C30	M-10
C31	A-5
C32	A-10
C33	G-4
C34	I-15
C35	I-7
C36	N-10
D1	B-3
D2	B-4
D3	D-1
D4	D-2
DA1	C-3
DA2	C-4
DA3	A-3
DA4	A-4
DA5	H-8
DA6	G-8
DA7	G-8
DA8	G-8
DA9	G-8
DA10	F-8
DS0	E-10
DS1	E-10
DS2	E-10
DS3	D-10
DT1	B-9
DT2	E-2
DT3	E-7
DT4	E-7
DT5	D-7
DT6	D-7
DT7	E-8
DT8	D-8
DT9	D-8
DT10	H-2
DT11	H-2
DT12	H-3
DT13	H-3
DT14	H-3
DT16	K-3
HIC1	L-5
HM	D-10
HS	D-10
IC1	B-6
IC2	B-9
IC3	G-3
IC4	H-6
IC5	H-8
IC6	H-10
J1	D-11
J2	L-11
J3	L-1
J4	B-1
L1	C-2
L2	C-2
L3	C-8
L4	C-8
L5	C-8
L6	I-7
L7	I-11
L8	L-10
Q1	E-3
Q2	K-3
R1	B-2
R2	B-2
R3	C-3
R4	B-3
R5	B-3
R6	A-3
R7	C-4
R8	C-4
R9	B-4
R10	B-4
R11	A-4
R12	A-4
R13	A-5
R14	C-8
R15	B-8
R16	B-18
R18	A-8
R19	A-8
R20	A-9
R21	A-9
R22	D-1
R23	E-2
R24	E-2
R25	D-2
R26	E-3
R27	E-3
R28	D-3
R29	D-3
R30	D-4
R31	D-5
R32	D-5
R33	E-7
R34	E-7
R35	D-7
R36	D-7
R37	D-8
R37A	D-9
R38	D-8
R39	H-2
R40	I-9
R41	F-5
R42	F-5
R43	G-7
R44	H-9
R45	L-2
R46	L-2
R47	L-3
R48	K-1
R49	K-3
R50	J-3
R52	H-10
RN1	E-6
RN2	H-2
RN3	H-4
RN4	K-2
RN5	I-6
TA1	M-4
TM	G-9
TP1A	C-5
TP1B	C-5
TP2A	C-5
TP2B	C-5
TP3	C-4
TP4	C-4
TP5	C-4
TP6	C-4
X1	F-4



DISK DRIVE BOARD

A Howard W. Sams GRIDTRACE™ Photo

LOGIC CHART (Continued)

FIXED DISK ADAPTER (PROGRAM C RUNNING)

PIN NO.	IC U28	IC U29	IC U30	PIN NO.	IC U30	IC U31	PIN NO.	IC U31	IC U32	IC U33	IC U34	IC U35	IC U36	IC U37
1	P	L	L	21	P	P	21	H	P	*	P	P	P	P
2	H	L	P	22	P	P	22	H	P	L	P	P	P	H
3	H	L	P	23	P	P	23	H	P	P	P	P	P	P
4	H	P	P	24	P	H	24	H	P	P	P	P	P	H
5	P	P	P	25	P	H	25	H	P	P	P	P	H	P
6	P	P	P	26	H	H	26	H	P	P	P	P	H	P
7	L	H	P	27	L	L	27	P	P	L	L	P	P	L
8	P	H	P	28	L	P	28	H	P	L	P	H	L	P
9	P	P	P	29	L	H	29	H	P	*	P	H	P	P
10	P	L	P	30	P	P	30	P	L	L	L	L	H	H
11	L	P	P	31	P	P	31	H	P	H(1)	P	P	H	P
12	H	H	P	32	P	P	32	H	P	H(1)	P	P	P	P
13	P	L	P	33	L	P	33	H	P	L(1)	H	P	P	H
14	H	L	P	34	L	P	34	H	P	H	H(1)	P	P	H
15		L	P	35	H	P	35	L	P		P	P	L	
16		H	P	36	H	P	36	P	P		P	P	H	
17		L	P	37	P	P	37	L	P		L	P		
18		H	P	38	P	P	38	L	P		L	P		
19		P	P	39	L	P	39	L	P		P	P		
20		H	L	40	H	L	40	H	H		H	H		

PIN NO.	IC U38	IC U39	IC U40	IC U41	IC U42	IC U43	IC U44	IC U45	IC U46	IC U47	IC U48	IC U49	IC U50	IC U51
1	L	H	-12.0	P	P	P	H	P	P	L	P	P	H	2.5
2	P	L	2.5	P	P	P	L	P	P	H	P	P	P	0
3	H	P	2.5	P	P	P	H	P	P	H	P	P	L	0
4	P	H	-12.0	P	P	P	P	P	P	P	L	H	L	1.5
5	P	H	-11.9	P	P	P	P	P	P	P	L	P	P	2.8
6	P	P	2.5	P	P	P	H	P	P	P	H	P	P	5.0
7	P	L	11.9	L	P	L	L	P	P	L	L	P	L	3.8
8	L	H	0	P	L	L	L	P	L	P	H	L	P	0
9	L	L		P	P	*	P	P	P	P	L	P	P	0
10	P	L		H	P	P	L	L	P	H	L	H	L	1.9
11	H	L		P	P	P	H	P	P	H	P	P	L	.2
12	P	L		P	H	P	P	P	P	L	P	P	P	3.3
13	P	L		H	H	P	P	P	P	L	H	P	H	3.3
14	P	P		H	L	H	H	P	P	H	H	H	H	3.0
15	L	P			L		L	P	P			H		5.0
16	H	P			H		H	P	H			H		5.0
17		P						P						
18		P						P						
19		L						P						
20		H						H						

LOGIC CHART (Continued)

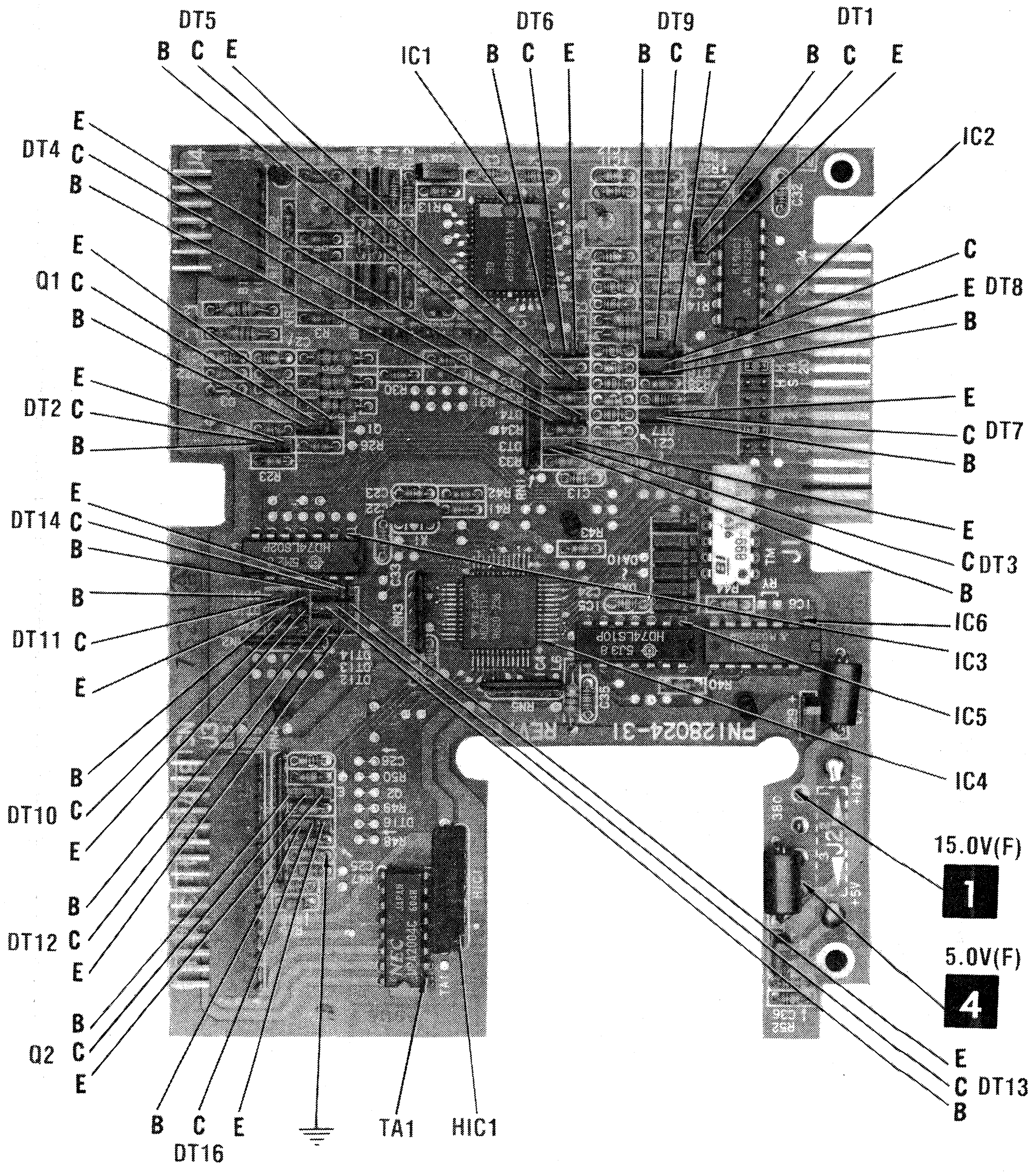
FIXED DISK ADAPTER (PROGRAM C RUNNING)

PIN NO.	IC U52	IC U53	PIN NO.	IC U53	IC U54	PIN NO.	IC U54	IC U55	IC U56	IC U57	IC U58	IC U59	IC U60	IC U61
1	P	P	21	P	P	21	P	P	L	P	H	P	H	P
2	P	P	22	L	P	22	L	P	P	P	H	P	H	P
3	P	P	23	L	P	23	L	P	P	P	H	P	P	P
4	P	P	24	H	P	24	H	P	P	H	P	P	P	P
5	P	P			P			P	P	L	H	H	P	P
6	P	P			P			P	*	H	P	L	P	P
7	L	P			P			*	H	*	L	L	L	P
8	P	P			P			P	L	L	P	P	P	P
9	P	P			P			P	P	L	P	P	*	P
10	P	P			P			L	P	L	H	H	*	L
11	P	P			P			P	P	H	L	L	P	P
12	P	L			L			P	P	H	L	L	P	P
13	P	P			P			P	P	H	L	H	*	P
14	H	P			P			P	P	L	H	H	H	P
15		P			P			P	L	L				P
16		P			P			P	H	H				P
17		P			P			P						P
18		L			L			P						P
19		P			P			P						P
20		P			P			H						H

PIN NO.	IC U62	IC U63
1	P	P
2	P	P
3	P	P
4	P	P
5	P	P
6	P	P
7	L	P
8	L	P
9	L	P
10	L	L
11	P	P
12	P	P
13	P	P
14	H	P
15		P
16		P
17		P
18		P
19		P
20		H

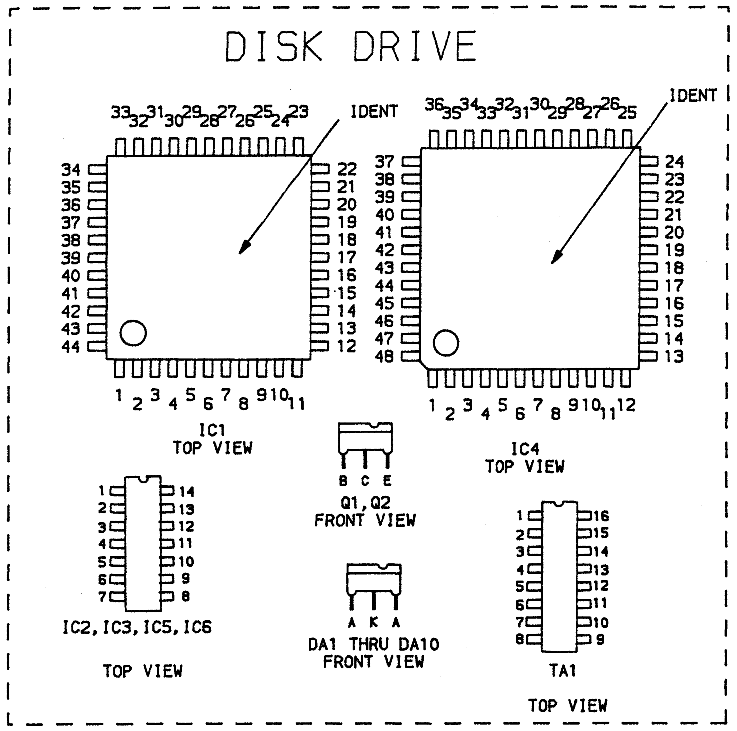
CSCS17-B

IBM PC/AT
MODEL 5170-239


DT5
B C E
IC1
DT6
B C E
DT9
B C E
DT1
B C E
IC2
DT4 E C B
Q1 E C B
DT2 E C B
DT14 E C B
DT11 B C E
DT10 B C E
DT12 B C E
Q2 B C E
B C E
DT16
TA1
HIC1
C E B DT8
E C B DT7
E C B DT3
IC6
IC3
IC5
IC4
15.0V(F)
1
5.0V(F)
4
E C B DT13

IC PINOUTS & TERMINAL GUIDES

DISK DRIVE


IDENT
IDENT
B C E
A K A

IC1
TOP VIEW

IC4
TOP VIEW

Q1, Q2
FRONT VIEW

DA1 THRU DA10
FRONT VIEW

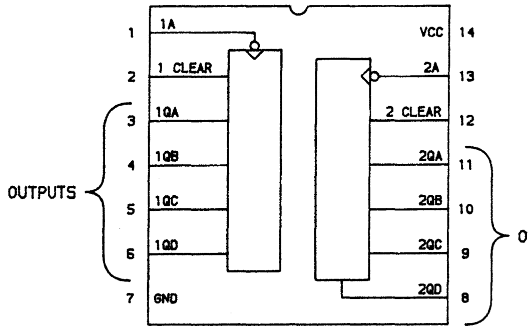
IC2, IC3, IC5, IC6

TOP VIEW

TA1

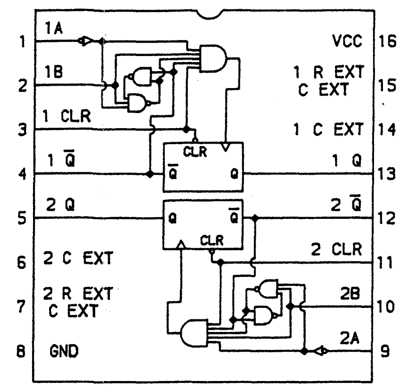
TOP VIEW

74LS393NA


1A
1 CLEAR
1QA
1QB
1QC
1QD
GND
VCC
2A
2 CLEAR
2QA
2QB
2QC
2QD
OUTPUTS
OUTPUTS

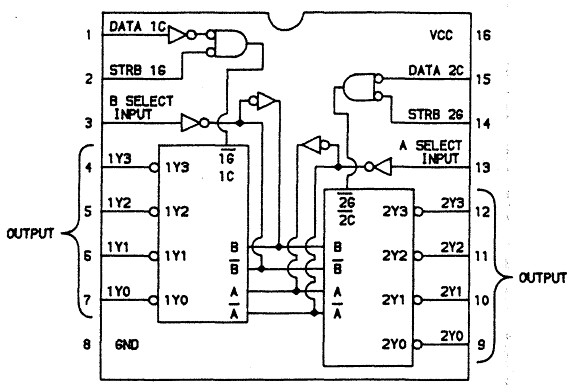
U52, U62
BINARY COUNTER
TOP VIEW

SN74LS221N


1A
1B
1 CLR
1 Q̄
2 Q
2 C EXT
2 R EXT
C EXT
GND
VCC
1 R EXT
C EXT
1 C EXT
1 Q
2 Q̄
2 CLR
2B
2A
CLR

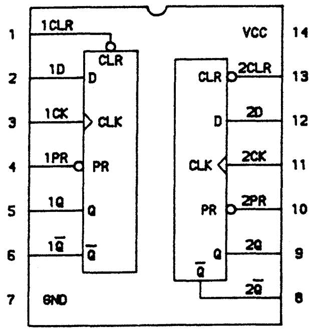
U38
MULTIVIBRATOR
TOP VIEW

74LS155NA

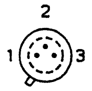

DATA 1C
STRB 1G
B SELECT INPUT
1Y3
1Y2
1Y1
1Y0
GND
VCC
DATA 2C
STRB 2G
A SELECT INPUT
2Y3
2Y2
2Y1
2Y0
OUTPUT
OUTPUT

U36
DECODER
TOP VIEW

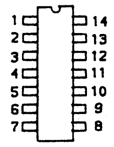
74S74PC, 74F74PC


1CLR
1D
1CK
1PR
1Q
1Q̄
GND
VCC
2CLR
2D
2CK
2PR
2Q
2Q̄

U1, U8, U23, U37
FLIP/FLOP
TOP VIEW



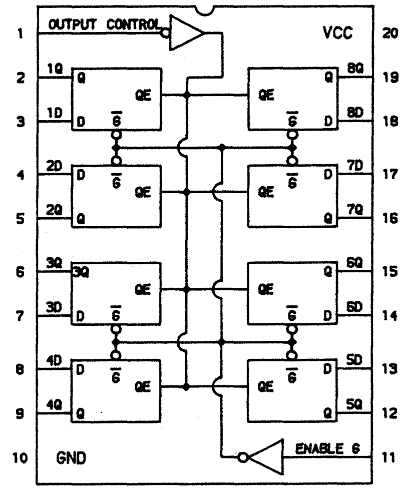
VR1, VR2
BOTTOM VIEW



U2, U3, U6, U9, U14, U15, U17, U20,
U21, U22, U28, U33, U41, U43,
U47, U48, U50, U58, U59, U60

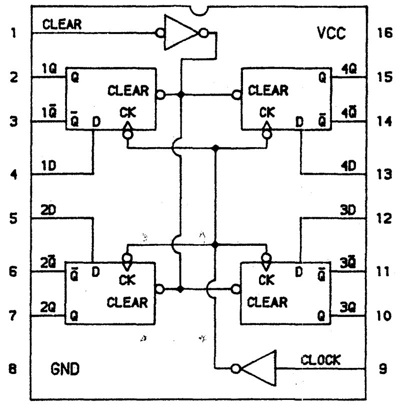
TOP VIEW

SN74LS373N


OUTPUT CONTROL
1Q
1D
2D
2Q
3Q
3D
4D
4Q
GND
VCC
8Q
8D
7D
7Q
6Q
6D
5D
5Q
ENABLE G

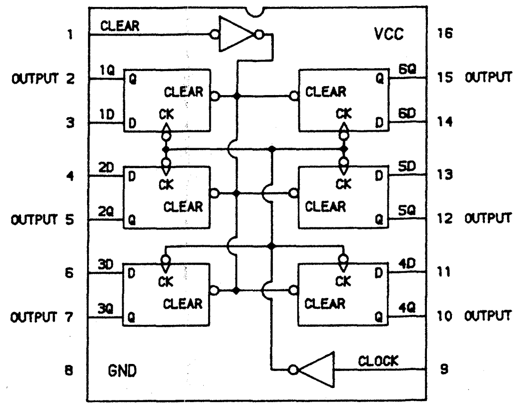
U25, U32, U34
LATCH
TOP VIEW

SN74LS175N

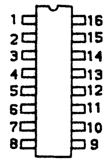

CLEAR
1Q
1Q̄
1D
2D
2Q̄
2Q
GND
VCC
4Q
4Q̄
4D
3D
3Q̄
3Q
CLOCK

U44
FLIP/FLOP
TOP VIEW

74S174NA, SN74LS174N

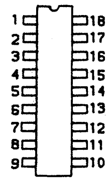

CLEAR
OUTPUT 2
1Q
1D
2D
OUTPUT 5
2Q
3D
OUTPUT 7
3Q
GND
VCC
6Q
6D
5D
5Q
4D
4Q
CLOCK
OUTPUT

U10, U26
FLIP/FLOP
TOP VIEW



U4, U11, U16, U27, U51

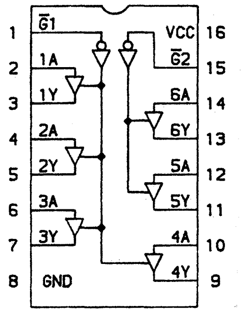
TOP VIEW



U13

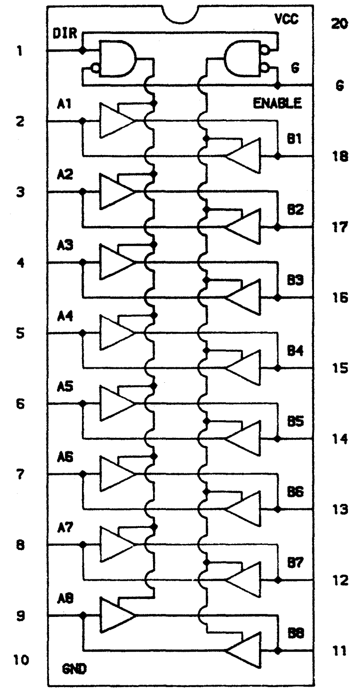
TOP VIEW

SN74LS367AN

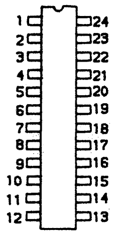

Ḡ1
1A
1Y
2A
2Y
3A
3Y
GND
VCC
Ḡ2
6A
6Y
5A
5Y
4A
4Y

U46, U56
BUFFER
TOP VIEW

74LS245NA

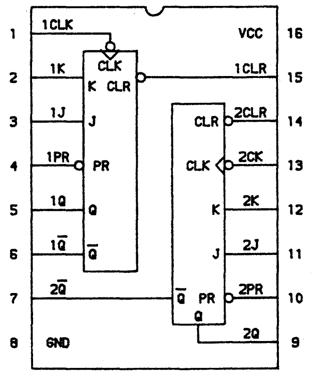

DIR
A1
A2
A3
A4
A5
A6
A7
A8
GND
VCC
G
ENABLE
B1
B2
B3
B4
B5
B6
B7
B8

U45, U55, U61, U63
TRANSCEIVER
TOP VIEW



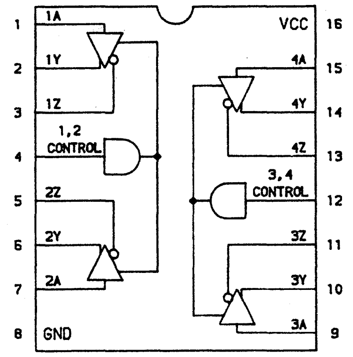
U53, U54
TOP VIEW

74LS112PC

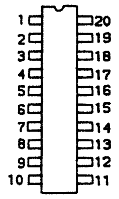

1CLK
1K
1J
1PR
1Q
1Q̄
2Q̄
GND
VCC
1CLR
2CLR
2CK
2K
2J
2PR
2Q

U49
FLIP/FLOP
TOP VIEW

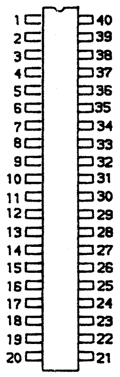
MC3487N


1A
1Y
1Z
1,2 CONTROL
2Z
2Y
2A
GND
VCC
4A
4Y
4Z
3,4 CONTROL
3Z
3Y
3A

U42, U57
TRI-STATE DRIVER
TOP VIEW

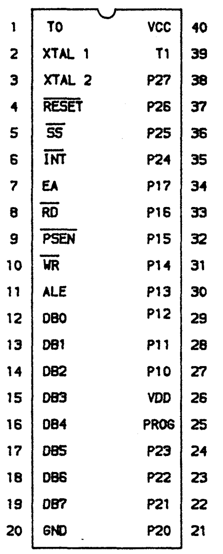


U19, U29, U35, U39
TOP VIEW



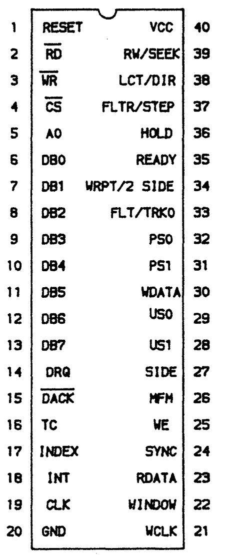
U18, U24
TOP VIEW

8049HC150


T0
XTAL 1
XTAL 2
RESET
SS̄
INT̄
EA
RD̄
PSEN̄
WR̄
ALE
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
GND
VCC
T1
P27
P26
P25
P24
P17
P16
P15
P14
P13
P12
P11
P10
VDD
PROG
P23
P22
P21
P20

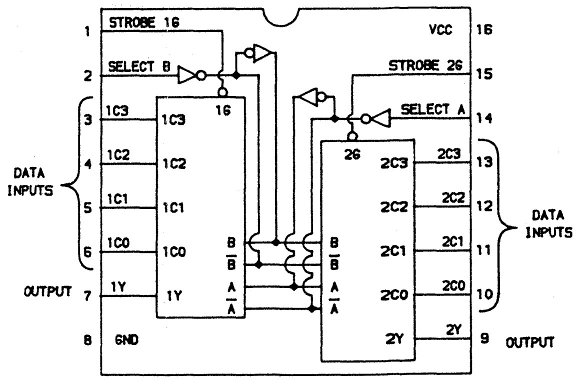
U31
MICROPROCESSOR
TOP VIEW

D765AC

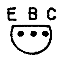

RESET
RD̄
WR̄
CS̄
A0
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
DRQ
DACK̄
TC
INDEX
INT
CLK
GND
VCC
RW/SEEK
LCT/DIR
FLTR/STEP
HOLD
READY
WRPT/2 SIDE
FLT/TRKO
PS0
PS1
WDATA
US0
US1
SIDE
MFM
WE
SYNC
RDATA
WINDOW
WCLK

U30
FLOPPY DISK CONTROLLER
TOP VIEW

SN74S153N

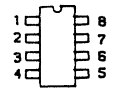

STROBE 1G
SELECT B
1C3
1C2
1C1
1C0
1Y
GND
VCC
STROBE 2G
SELECT A
2C3
2C2
2C1
2C0
2Y
DATA INPUTS
DATA INPUTS
OUTPUT
OUTPUT

U12
CONTROLLER
TOP VIEW



Q1 THRU Q6

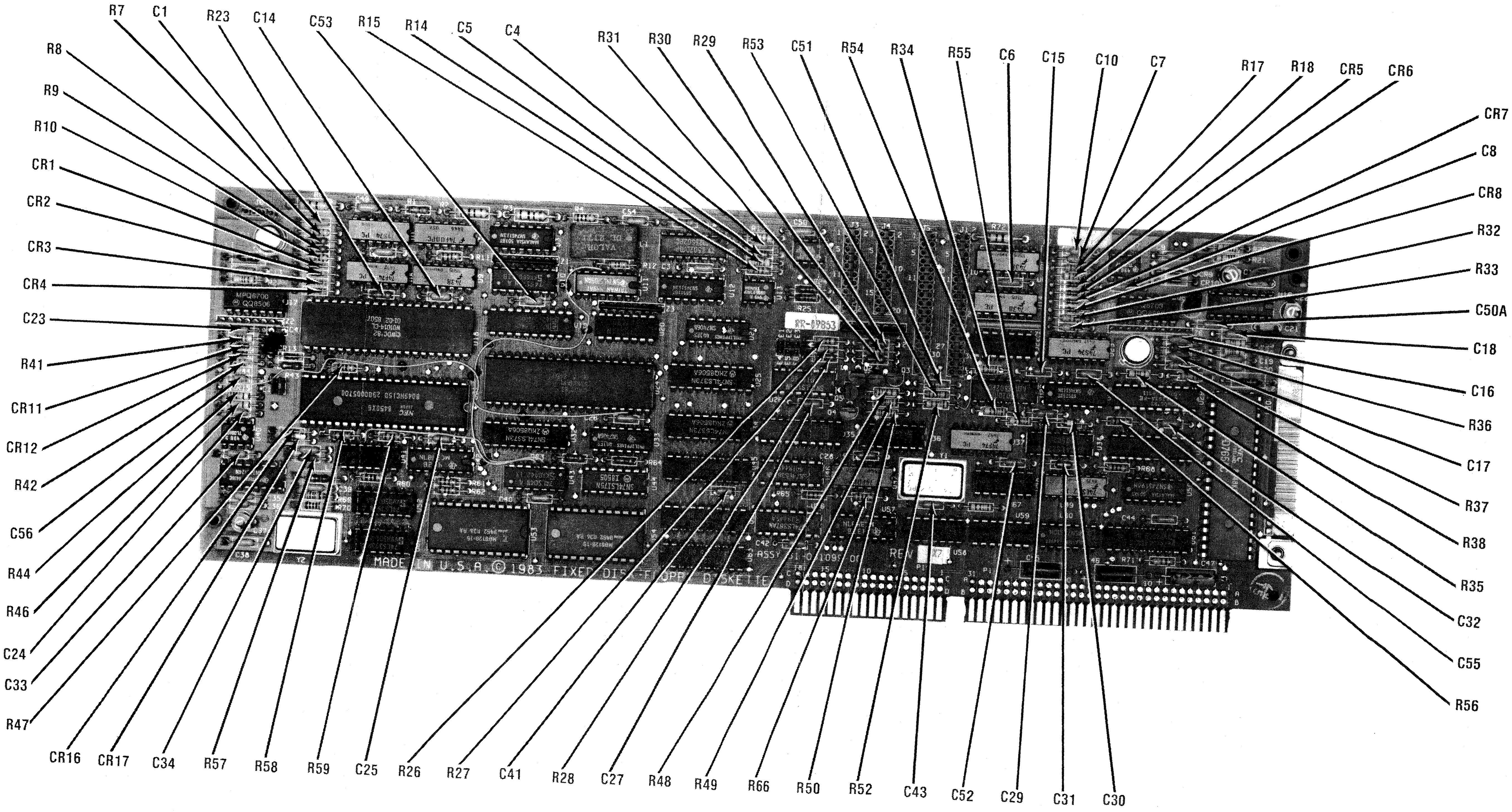
BOTTOM VIEW



U5, U7, U40

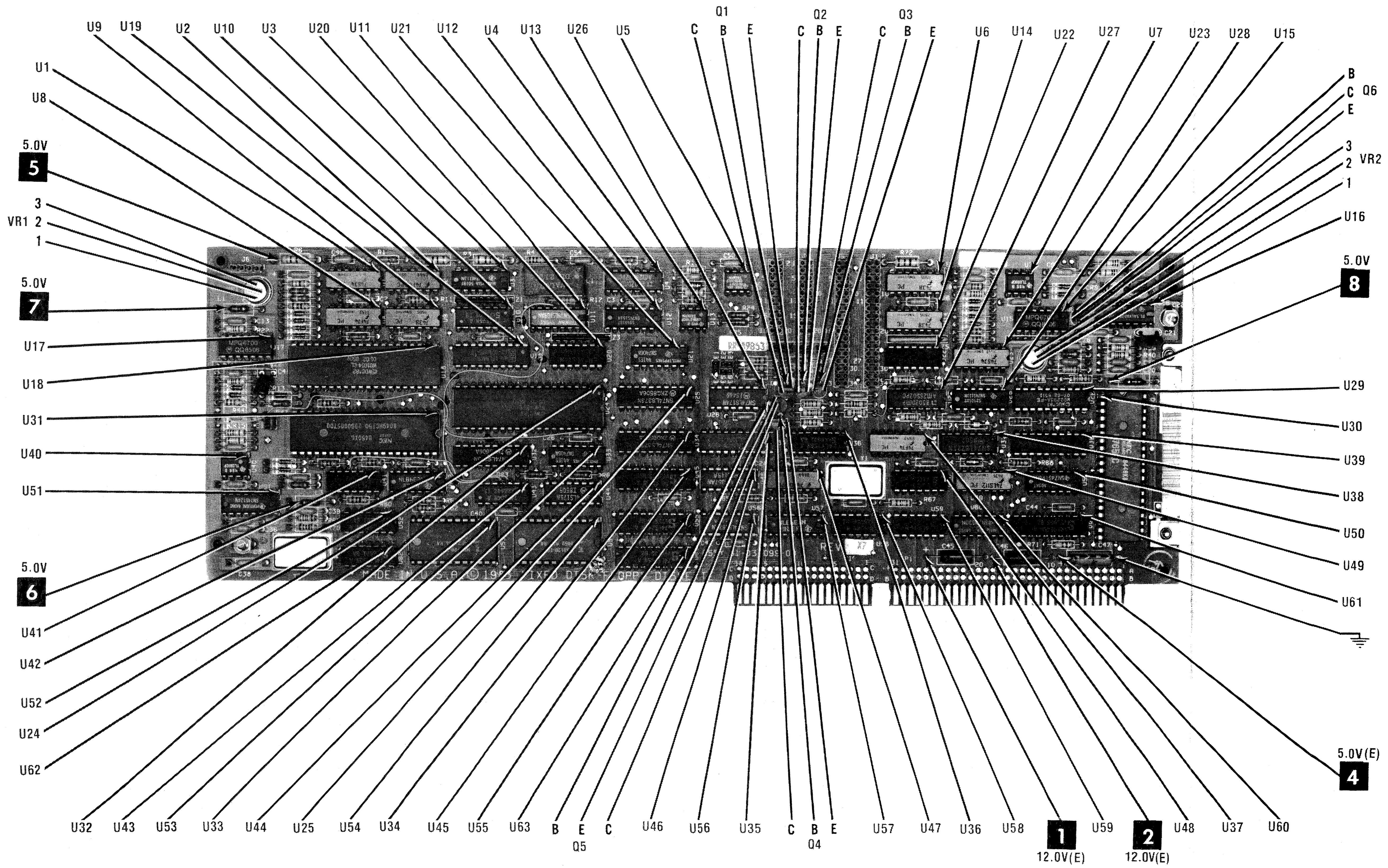
TOP VIEW

IBM PC/AT
MODEL 5170-239


R7
C1
R23
C14
C53
R15
R14
C5
C4
R31
R30
R29
R53
C51
R54
R34
R55
C6
C15
C10
C7
R17
R18
CR5
CR6
R8
R9
R10
CR1
CR2
CR3
CR4
C23
R41
CR11
CR12
R42
C56
R44
R46
C24
C33
R47
CR7
C8
CR8
R32
R33
C50A
C18
C16
R36
C17
R37
R38
R35
C32
C55
R56
CR16
CR17
C34
R57
R58
R59
C25
R26
R27
C41
R28
C27
R48
R49
R66
R50
R52
C43
C52
C29
C31
C30
MADE IN U.S.A. © 1983 FIXED DISK-FLOPPY DISKETTE

CSCS17-B

IBM PC/AT
MODEL 5170-239


U9
U19
U2
U10
U3
U20
U11
U21
U12
U4
U13
U26
U5
Q1
C
B
E
Q2
C
B
E
Q3
C
B
E
U6
U14
U22
U27
U7
U23
U28
U15
U1
U8
5.0V
5
3
VR1 2
1
5.0V
7
U17
U18
U31
U40
U51
5.0V
6
U41
U42
U52
U24
U62
B
C Q6
E
3
2 VR2
1
U16
5.0V
8
U29
U30
U39
U38
U50
U49
U61
5.0V(E)
4
U32
U43
U53
U33
U44
U25
U54
U34
U45
U55
U63
B
E
C
Q5
U46
U56
U35
C
B
E
Q4
U57
U47
U36
U58
1
12.0V(E)
U59
2
12.0V(E)
U48
U37
U60

A Howard W. Sams CIRCUITRACE® Photo

SCHEMATIC NOTES

DISK DRIVE INTERFACE AND DISK DRIVE NOTES

Voltage, waveforms and logic readings for the disk drive interface and disk drive taken while running the following Basic program. Readings shown were taken when the disk drive head is not moving unless noted.
Note: Insert a formatted diskette (360K) (not write protected) in Drive A before running the program.

DRIVE A PROGRAM

```
10  OPEN "A:SAMS.DAT" FOR OUTPUT AS #1
20  FOR X = 1 TO 300
30  PRINT #1, "HOWARD W. SAMS"
40  NEXT X
50  CLOSE #1
60  GOTO 10
```

DRIVE C PROGRAM

```
10  OPEN "C:SAMS.DAT" FOR OUTPUT AS #1
20  FOR X = 1 to 700
30  PRINT #1, "HOWARD W. SAMS"
40  NEXT X
50  CLOSE #1
60  GOTO 10
```

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No lights On)

(1) Probe indicates P when head is moving.
(2) Probe indicates H if diskette is write protected.
(3) Probe indicates H when the head is on track 00 and L when off track 00.
(4) Probe indicates L if diskette is write protected.
(5) Probe indicates L when the head is on track 00 and H when off track 00.
(6) Probe indicates H when head 0 is selected, L when head 1 is selected.
(7) Probe indicates H when head is moving.

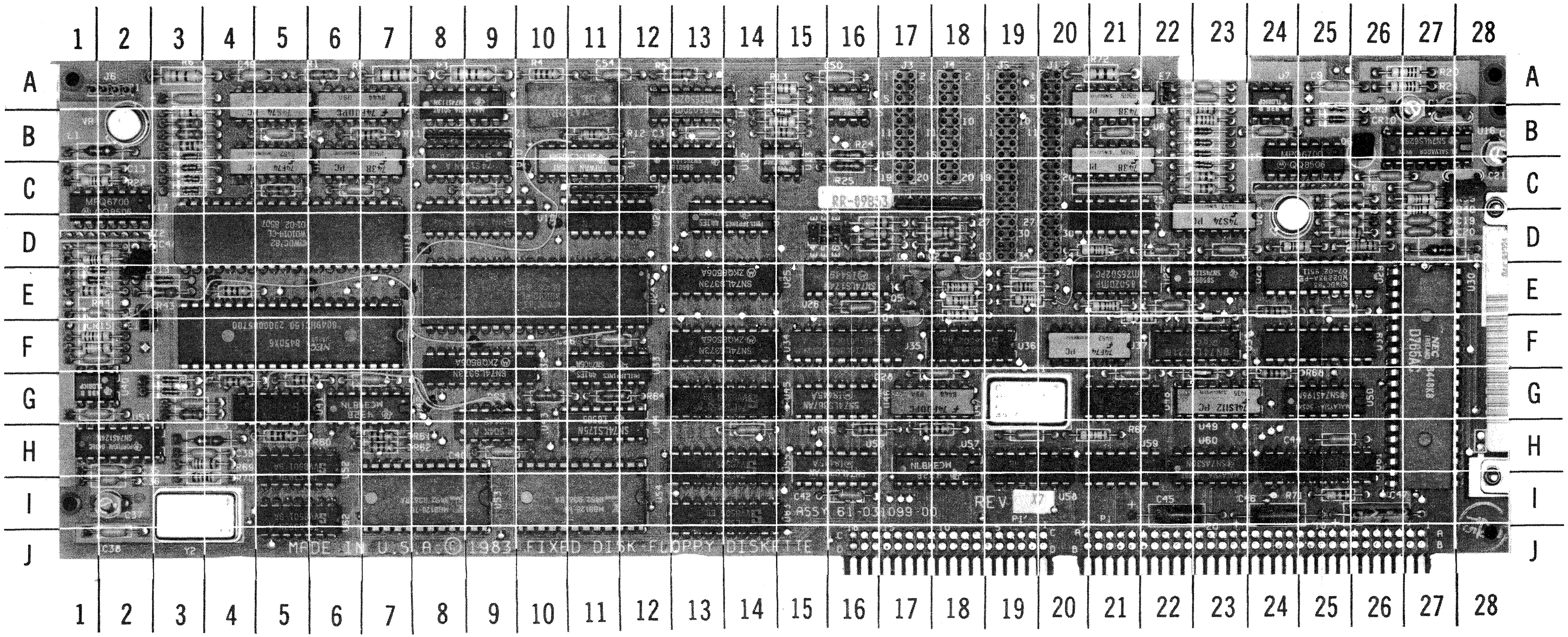
Waveforms and voltages taken from ground, unless noted otherwise.

Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on "0" reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7.5cm. width with DC reference voltage given at the bottom line of each waveform.

-×- Circuitry not used in some versions
--- Circuitry used in some versions
⊖ See parts list
⏚ Ground
⫨ Chassis
▽ Common tie point

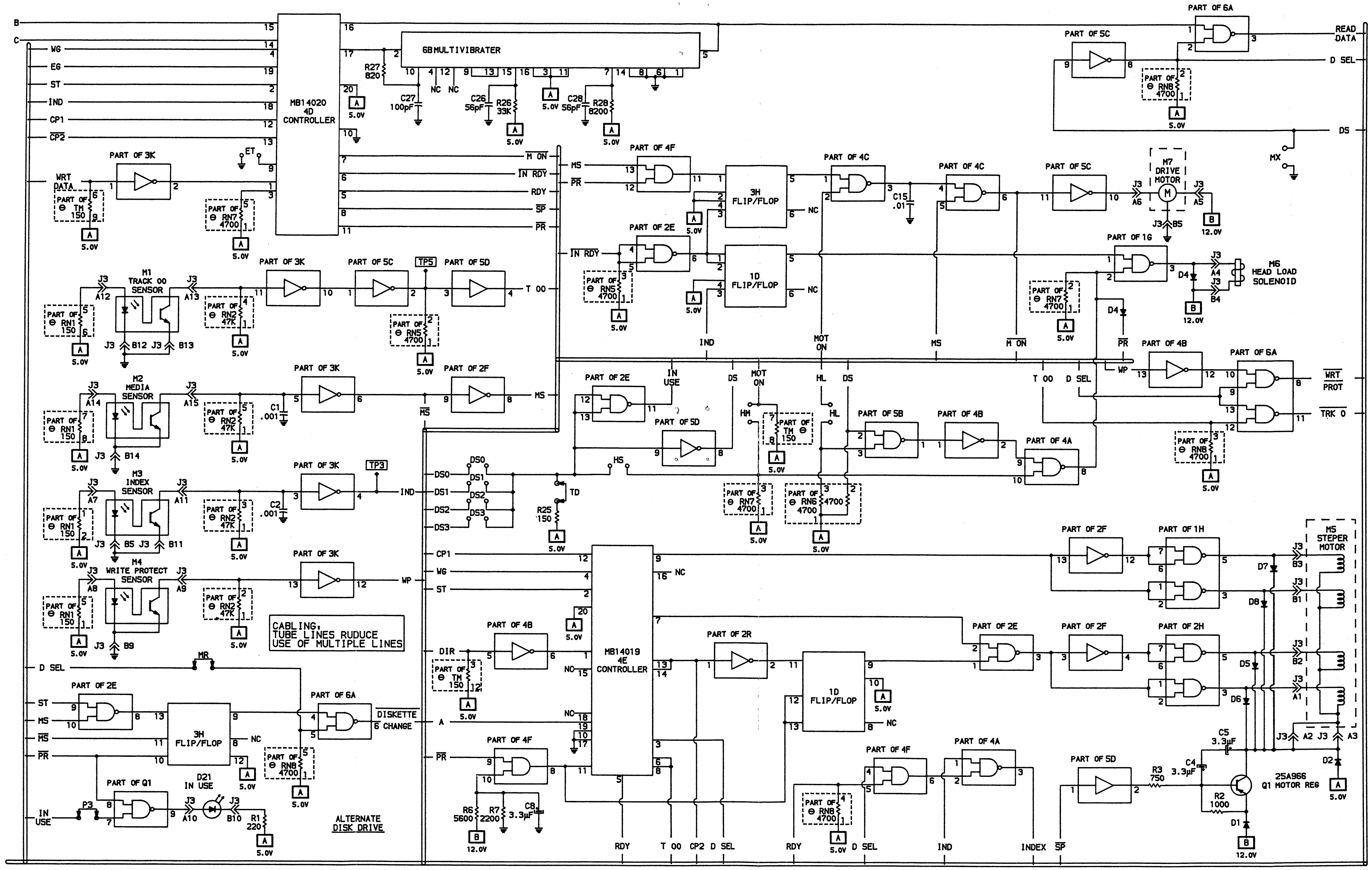
FIXED DISK/FLOPPY DISK ADAPTER GridTrace LOCATION GUIDE

C1	A-3	E2	D-15	R54	E-21	U56	H-16
C2	B-5	E3	D-16	R55	F-21	U57	H-18
C3	B-13	E4	D-15	R56	E-24	U58	I-20
C4	A-15	E5	D-15	R57	G-3	U59	H-21
C5	B-15	E6	D-16	R58	G-4	U60	H-23
C6	B-21	E7	A-22	R59	G-5	U61	H-25
C7	A-23	E8	A-22	R60	H-5	U62	I-6
C8	B-24	E11	E-2	R61	H-7	U63	I-14
C9	A-25	E12	F-2	R62	H-7	VR1	B-2
C10	A-23	J1	A-20	R63	G-10	VR2	D-24
C11	B-27	J3	A-17	R64	G-11	Y1	G-19
C12	B-27	J4	A-18	R65	H-16	Y2	I-3
C13	C-1	J5	A-19	R66	H-18	Z1	B-9
C14	C-6	J6	A-2	R67	H-21	Z2	D-2
C15	D-22	L1	B-1	R68	G-24	Z3	C-12
C16	C-25	L2	D-27	R69	H-4	Z4	B-16
C17	D-25	L3	H-4	R70	I-4	Z5	C-21
C18	C-27	P1	J-24	R71	I-25	Z6	C-25
C19	D-27	P1	J-18	R72	A-21		
C20	D-27	Q1	E-17	U1	A-5		
C21	C-28	Q2	E-18	U2	A-7		
C22	B-28	Q3	E-18	U3	A-9		
C23	D-1	Q4	F-17	U4	A-13		
C24	F-1	Q5	E-17	U5	A-16		
C25	G-7	Q6	B-26	U6	A-21		
C26	F-11	R1	A-6	U7	A-24		
C27	E-16	R2	A-7	U8	C-5		
C28	G-18	R3	A-9	U9	C-7		
C29	E-22	R4	A-10	U10	C-9		
C30	F-23	R5	A-13	U11	C-11		
C31	G-23	R6	A-3	U12	C-13		
C32	E-25	R7	B-3	U13	C-15		
C33	G-1	R8	B-3	U14	C-21		
C34	G-3	R9	B-3	U15	B-25		
C35	H-2	R10	B-3	U16	B-27		
C36	I-2	R11	B-7	U17	C-2		
C37	I-2	R12	B-11	U18	D-5		
C38	J-2	R13	A-15	U19	D-9		
C39	H-4	R14	B-15	U20	D-12		
C40	H-9	R15	B-15	U21	D-14		
C41	H-14	R17	B-23	U22	D-21		
C42	I-16	R18	B-23	U23	D-23		
C43	H-19	R20	A-27	U24	E-10		
C44	H-25	R21	A-27	U25	E-14		
C45	I-22	R22	C-1	U26	E-16		
C46	I-24	R23	C-5	U27	E-21		
C47	I-26	R24	B-16	U28	E-23		
C48	D-2	R25	C-16	U29	E-25		
C49	A-4	R26	D-16	U30	F-27		
C50	A-16	R27	D-16	U31	F-5		
C50A	C-26	R28	D-16	U32	F-9		
C51	E-19	R29	D-18	U33	F-12		
C52	G-21	R30	D-18	U34	F-14		
C53	C-9	R31	D-18	U35	F-16		
C54	A-11	R32	C-23	U36	F-18		
C55	D-23	R33	C-23	U37	F-21		
C56	E-1	R34	D-21	U38	F-23		
CR1	B-3	R35	D-24	U39	F-25		
CR2	C-3	R36	C-25	U40	G-1		
CR3	C-3	R37	D-25	U41	G-5		
CR4	C-3	R38	D-26	U42	G-7		
CR5	B-23	R39	C-27	U43	H-9		
CR6	B-23	R40	C-27	U44	H-11		
CR7	B-23	R41	D-1	U45	G-14		
CR8	C-23	R42	E-1	U46	G-16		
CR9	B-25	R43	E-3	U47	G-18		
CR10	B-25	R44	F-1	U48	G-21		
CR11	E-1	R46	F-1	U49	G-23		
CR12	E-1	R47	E-4	U50	G-25		
CR13	E-3	R48	E-18	U51	H-2		
CR16	G-3	R49	E-18	U52	H-6		
CR17	G-3	R50	E-18	U53	I-8		
DL1	A-11	R51	E-19	U54	I-11		
E1	D-15	R52	E-19	U55	H-14		

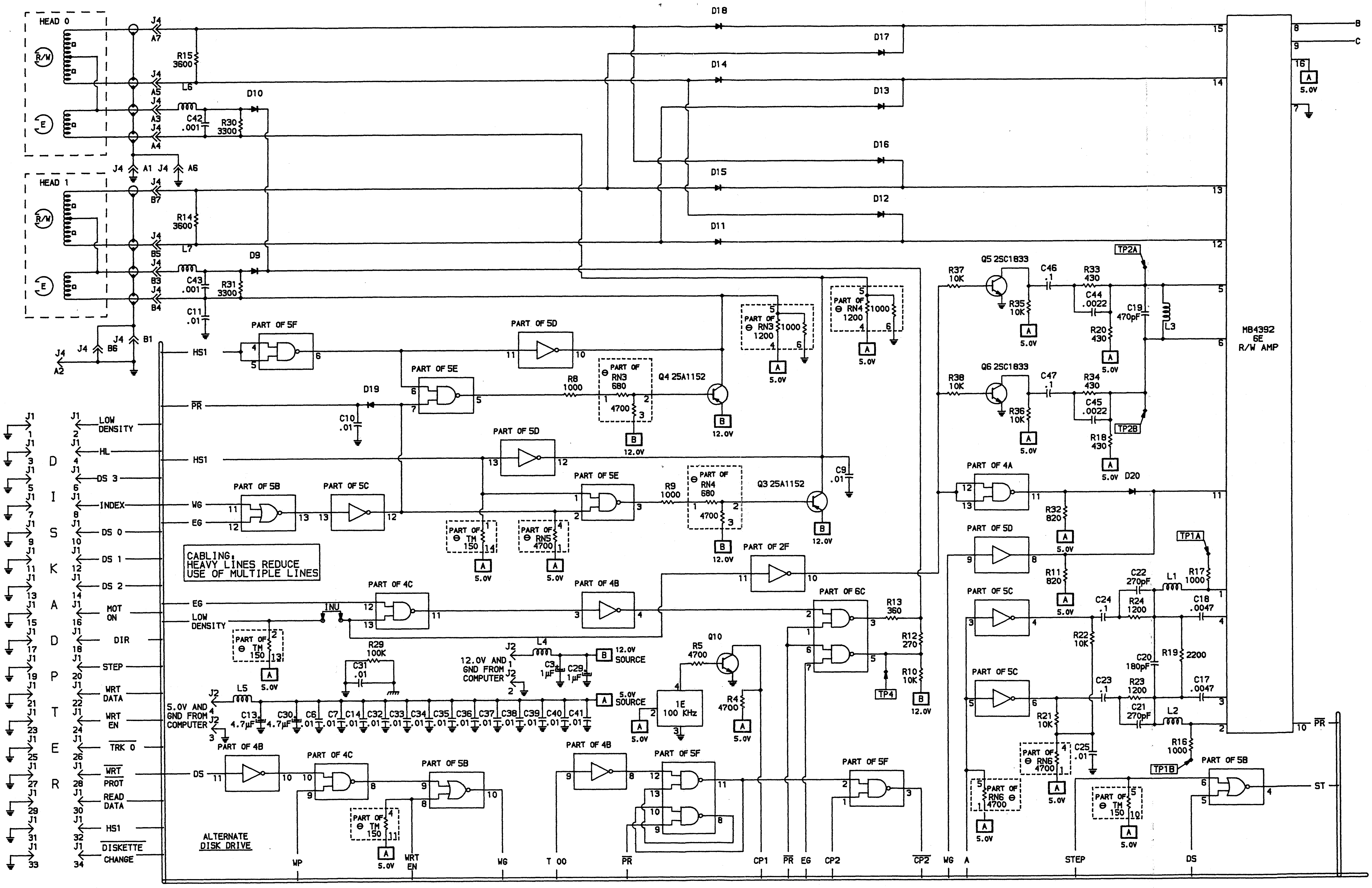

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
A
B
C
D
E
F
G
H
I
J
MADE IN U.S.A. © 1983 FIXED DISK-FLOPPY DISKETTE
ASSY 61-031099-00
REV X7

IBM PC/AT
MODEL 5170-239

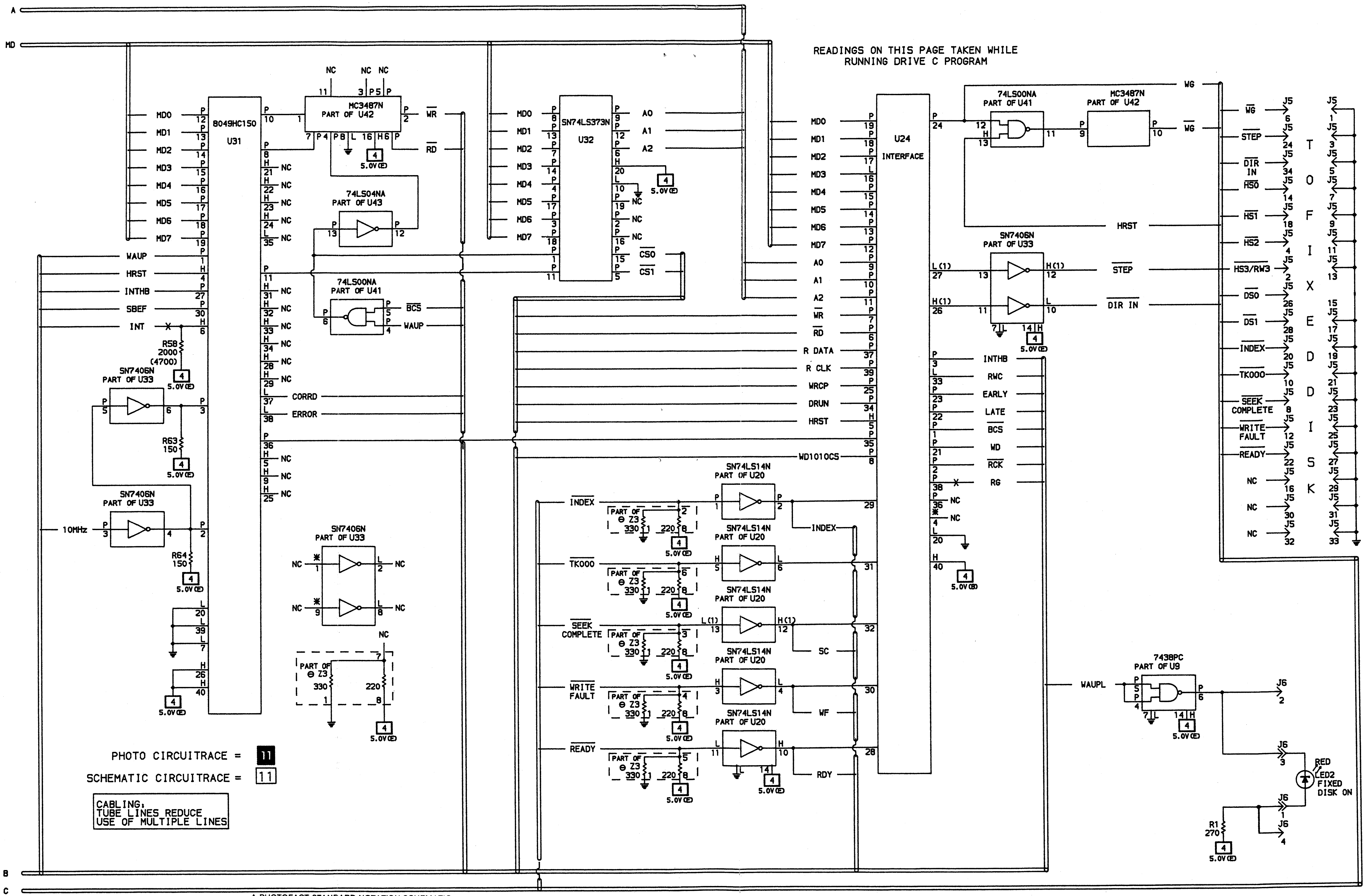
A Howard W. Sams GRIDTRACE™ Photo


MB14020
4D
CONTROLLER
6B MULTIVIBRATER
R27 820
C27 100pF
C26 56pF
R26 33K
C28 56pF
R28 8200
5.0V
WRT DATA
PART OF 3K
PART OF TM 150
PART OF RN7 4700
M ON
IN RDY
RDY
SP
PR
MS
PART OF 4F
3H FLIP/FLOP
1D FLIP/FLOP
PART OF 2E
PART OF RN5 4700
PART OF 4C
C15 .01
PART OF 5C
M7 DRIVE MOTOR
J3 A6
J3 A5
J3 B5
12.0V
PART OF 1G
M6 HEAD LOAD SOLENOID
D4
PART OF 6A
READ DATA
D SEL
PART OF RN8 4700
DS
MX
M1 TRACK 00 SENSOR
PART OF RN1 150
PART OF RN2 47K
PART OF 5D
TP5
T 00
M2 MEDIA SENSOR
C1 .001
PART OF 2F
M3 INDEX SENSOR
C2 .001
TP3
IND
M4 WRITE PROTECT SENSOR
WP
CABLING,
TUBE LINES RUDUCE
USE OF MULTIPLE LINES
IND
MOT ON
PR
PART OF 4B
WRT PROT
TRK 0
IN USE
HM
HL
HS
PART OF 5B
PART OF 4A
PART OF RN6 4700
DS0
DS1
DS2
DS3
TD
R25 150
CP1
WG
ST
MB14019
4E
CONTROLLER
DIR
PART OF 2R
PART OF 1H
PART OF 2H
M5 STEPER MOTOR
D7
D8
D5
D6
D SEL
MR
ST
MS
PR
3H FLIP/FLOP
DISKETTE CHANGE
PART OF Q1
D21 IN USE
R1 220
IN USE
P3
ALTERNATE DISK DRIVE
R6 5600
R7 2200
C8 3.3µF
C5 3.3µF
C4 3.3µF
R3 750
R2 1000
D1
D2
25A966
Q1 MOTOR REG
RDY
T 00
CP2
INDEX
SP

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE


HEAD 0
R/W
E
HEAD 1
J4 A7
J4 A5
J4 A3
J4 A4
J4 A1
J4 A6
J4 B7
J4 B5
J4 B3
J4 B4
J4 B6
J4 B1
J4 A2
R15 3600
R14 3600
L6
L7
C42 .001
C43 .001
R30 3300
R31 3300
C11 .01
D10
D9
D18
D17
D14
D13
D16
D15
D12
D11
D19
D20
MB4392
6E
R/W AMP
Q5 2SC1833
Q6 2SC1833
Q4 2SA1152
Q3 2SA1152
Q10
R37 10K
R38 10K
R35 10K
R36 10K
C46 .1
C47 .1
R33 430
R34 430
C44 .0022
C45 .0022
C19 470pF
L3
R20 430
R18 430
TP2A
TP2B
TP1A
TP1B
TP4
PART OF 5F
PART OF 5D
PART OF 5E
PART OF 5B
PART OF 5C
PART OF 4C
PART OF 4B
PART OF 4A
PART OF 2F
PART OF 6C
PART OF RN3 1200 1000
PART OF RN4 1200 1000
PART OF RN3 680 4700
PART OF RN4 680 4700
PART OF TM 150
PART OF RN5 4700
PART OF RN6 4700
R8 1000
R9 1000
C10 .01
C9 .01
R32 820
R11 820
R13 360
R12 270
R10 10K
R17 1000
R16 1000
R22 10K
R21 10K
R24 1200
R23 1200
R19 2200
C22 270pF
C21 270pF
C20 180pF
C24 .1
C23 .1
C18 .0047
C17 .0047
C25 .01
L1
L2
L4
L5
R29 100K
C31 .01
R5 4700
R4 4700
1E 100 KHz
C3 1µF
C29 1µF
C13 4.7µF
C30 4.7µF
C6 C7 C14 C32 C33 C34 C35 C36 C37 C38 C39 C40 C41 .01
12.0V AND GND FROM COMPUTER
5.0V AND GND FROM COMPUTER
12.0V SOURCE
5.0V SOURCE
INU
CABLING:
HEAVY LINES REDUCE
USE OF MULTIPLE LINES
HS1
PR
WG
EG
LOW DENSITY
DS
ST
LOW DENSITY
HL
DS 3
INDEX
DS 0
DS 1
DS 2
MOT ON
DIR
STEP
WRT DATA
WRT EN
TRK 0
WRT PROT
READ DATA
HS1
DISKETTE CHANGE
DISK ADAPTER
ALTERNATE DISK DRIVE
WP
WRT EN
WG
T 00
PR
CP1
PR
EG
CP2
CP2
WG
A
STEP
DS
A 5.0V
B 12.0V

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE


READINGS ON THIS PAGE TAKEN WHILE RUNNING DRIVE C PROGRAM
8049HC150 U31
MC3487N PART OF U42
74LS04NA PART OF U43
74LS00NA PART OF U41
SN74LS373N U32
U24 INTERFACE
SN7406N PART OF U33
SN74LS14N PART OF U20
7438PC PART OF U9
MC3487N PART OF U42
74LS00NA PART OF U41
MD0
MD1
MD2
MD3
MD4
MD5
MD6
MD7
WAUP
HRST
INTHB
SBEF
INT
10MHz
A0
A1
A2
CS0
CS1
WR
RD
BCS
CORRD
ERROR
R DATA
R CLK
WRCP
DRUN
WD1010CS
INDEX
TK000
SEEK COMPLETE
WRITE FAULT
READY
SC
WF
RDY
WG
STEP
DIR IN
HS0
HS1
HS2
HS3/RW3
DS0
DS1
RWC
EARLY
LATE
WD
RCK
RG
WAUPL
RED LED2 FIXED DISK ON
R1 270
R58 2000 (4700)
R63 150
R64 150
5.0V
NC
J5
J6
TO FIXED DISK
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
CABLING; TUBE LINES REDUCE USE OF MULTIPLE LINES
A
MD
B
C

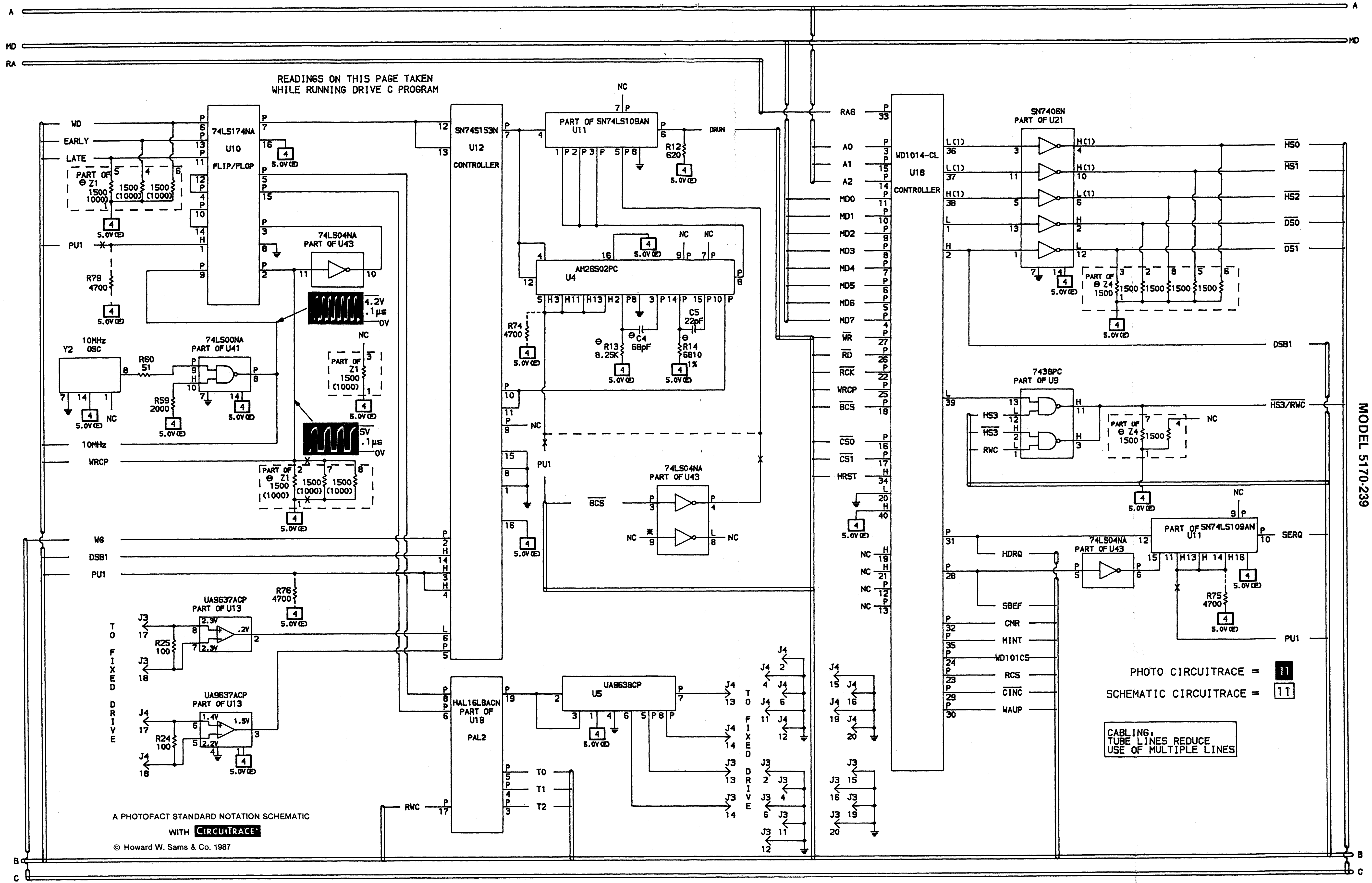
CSCS17-B

IBM PC/AT
MODEL 5170-239

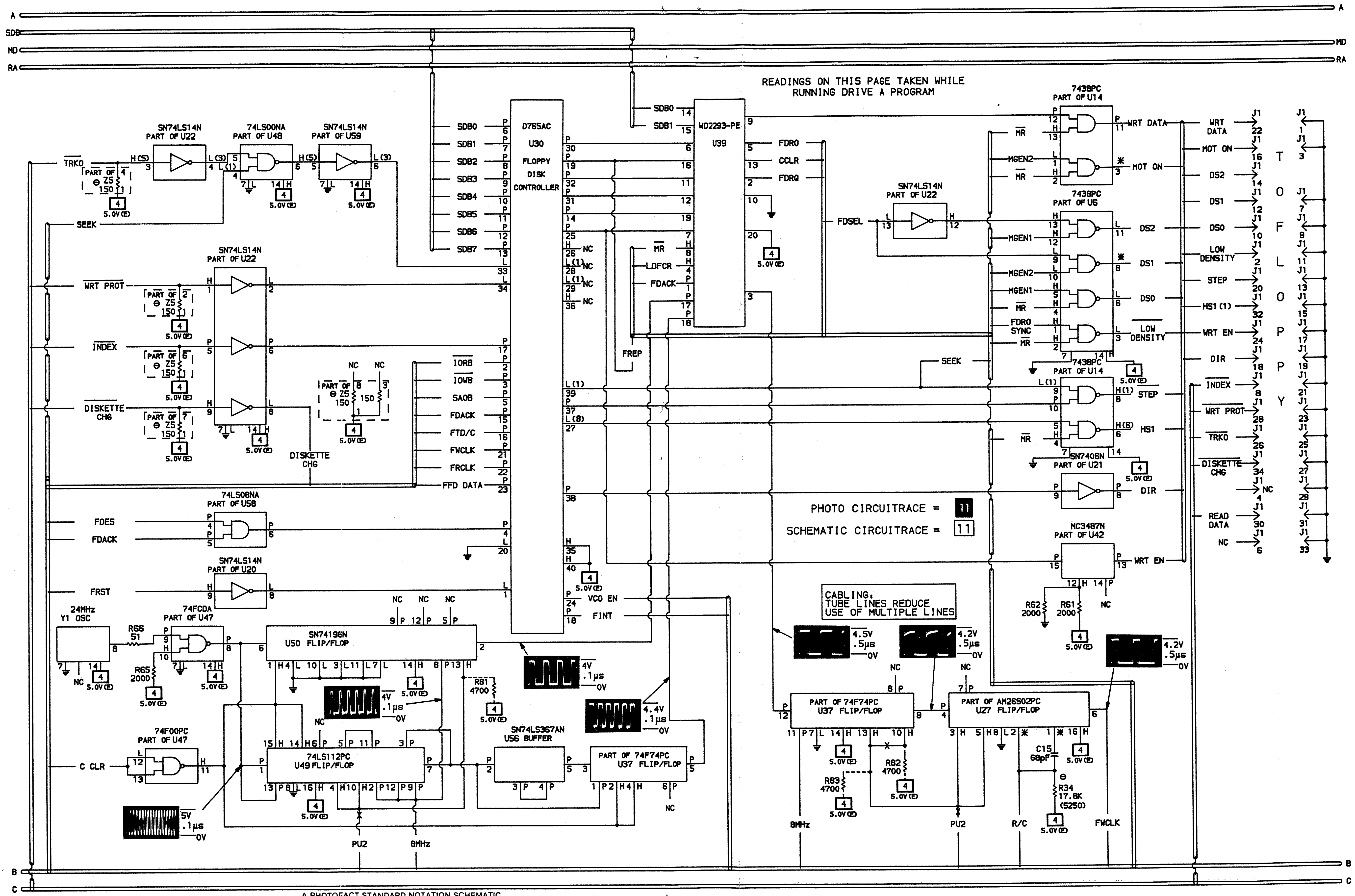
FIXED DISK/FLOPPY DISK ADAPTER

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE

FIXED DISK/FLOPPY DISK ADAPTER


READINGS ON THIS PAGE TAKEN
WHILE RUNNING DRIVE C PROGRAM
A
MD
RA
B
C
WD
EARLY
LATE
PU1
10MHz
WRCP
WG
DSB1
74LS174NA
U10
FLIP/FLOP
PART OF Θ Z1
1500 (1000)
R79 4700
5.0V
Y2 10MHz OSC
R60 51
R59 2000
74LS00NA PART OF U41
74LS04NA PART OF U43
4.2V .1µs 0V
5V .1µs 0V
NC
SN74S153N
U12
CONTROLLER
R76 4700
UA9637ACP PART OF U13
J3 17
J3 18
J4 17
J4 18
R25 100
R24 100
2.3V
.2V
1.4V
1.5V
2.2V
TO FIXED DRIVE
HAL16L8ACN PART OF U19
PAL2
RWC
T0
T1
T2
PART OF SN74LS109AN U11
R12 620
DRUN
AM26S02PC U4
R74 4700
Θ R13 8.25K
Θ C4 68pF
C5 22pF
Θ R14 6810 1%
BCS
UA9638CP U5
TO FIXED DRIVE
RA6
A0
A1
A2
MD0
MD1
MD2
MD3
MD4
MD5
MD6
MD7
WR
RD
RCK
WRCP
BCS
CS0
CS1
HRST
WD1014-CL
U18
CONTROLLER
SN7406N PART OF U21
HS0
HS1
HS2
DS0
DS1
PART OF Θ Z4 1500
DSB1
7438PC PART OF U9
HS3
RWC
HS3/RWC
HDRQ
SBEF
CMR
MINT
WD101CS
RCS
CINC
WAUP
74LS04NA PART OF U43
PART OF SN74LS109AN U11
SERQ
R75 4700
PU1
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE


READINGS ON THIS PAGE TAKEN WHILE RUNNING DRIVE A PROGRAM
D765AC U30 FLOPPY DISK CONTROLLER
WD2293-PE U39
SN74LS14N PART OF U22
74LS00NA PART OF U48
SN74LS14N PART OF U59
74LS08NA PART OF U58
SN74LS14N PART OF U20
74FCDA PART OF U47
74F00PC PART OF U47
24MHz Y1 OSC
SN74196N U50 FLIP/FLOP
74LS112PC U49 FLIP/FLOP
SN74LS367AN U56 BUFFER
PART OF 74F74PC U37 FLIP/FLOP
PART OF AM26S02PC U27 FLIP/FLOP
7438PC PART OF U14
7438PC PART OF U6
SN7406N PART OF U21
MC3487N PART OF U42
TRKO
SEEK
WRT PROT
INDEX
DISKETTE CHG
FDES
FDACK
FRST
C CLR
SDB0
SDB1
SDB2
SDB3
SDB4
SDB5
SDB6
SDB7
IORB
IOWB
SA0B
FTD/C
FWCLK
FRCLK
FFD DATA
VCO EN
FINT
FDRO
CCLR
FDRQ
FDSEL
MR
LDFCR
FREP
MGEN1
MGEN2
SYNC
WRT DATA
MOT ON
DS2
DS1
DS0
LOW DENSITY
STEP
HS1
DIR
WRT EN
READ DATA
NC
PU2
8MHz
R/C
CABLING, TUBE LINES REDUCE USE OF MULTIPLE LINES
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
T O P O F C O P Y
J1
A
SDB
MD
RA
B
C

CSCS17-B

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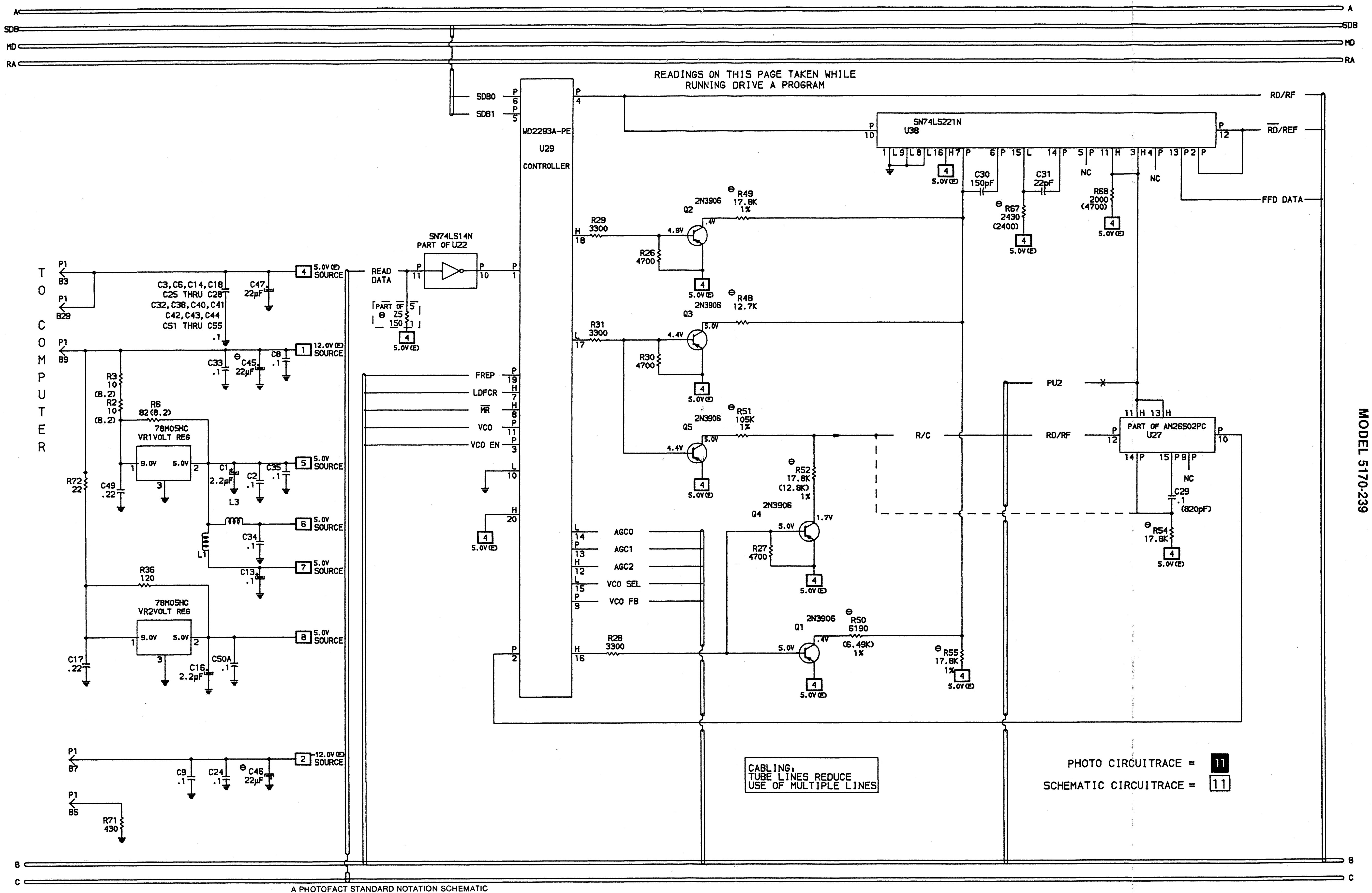
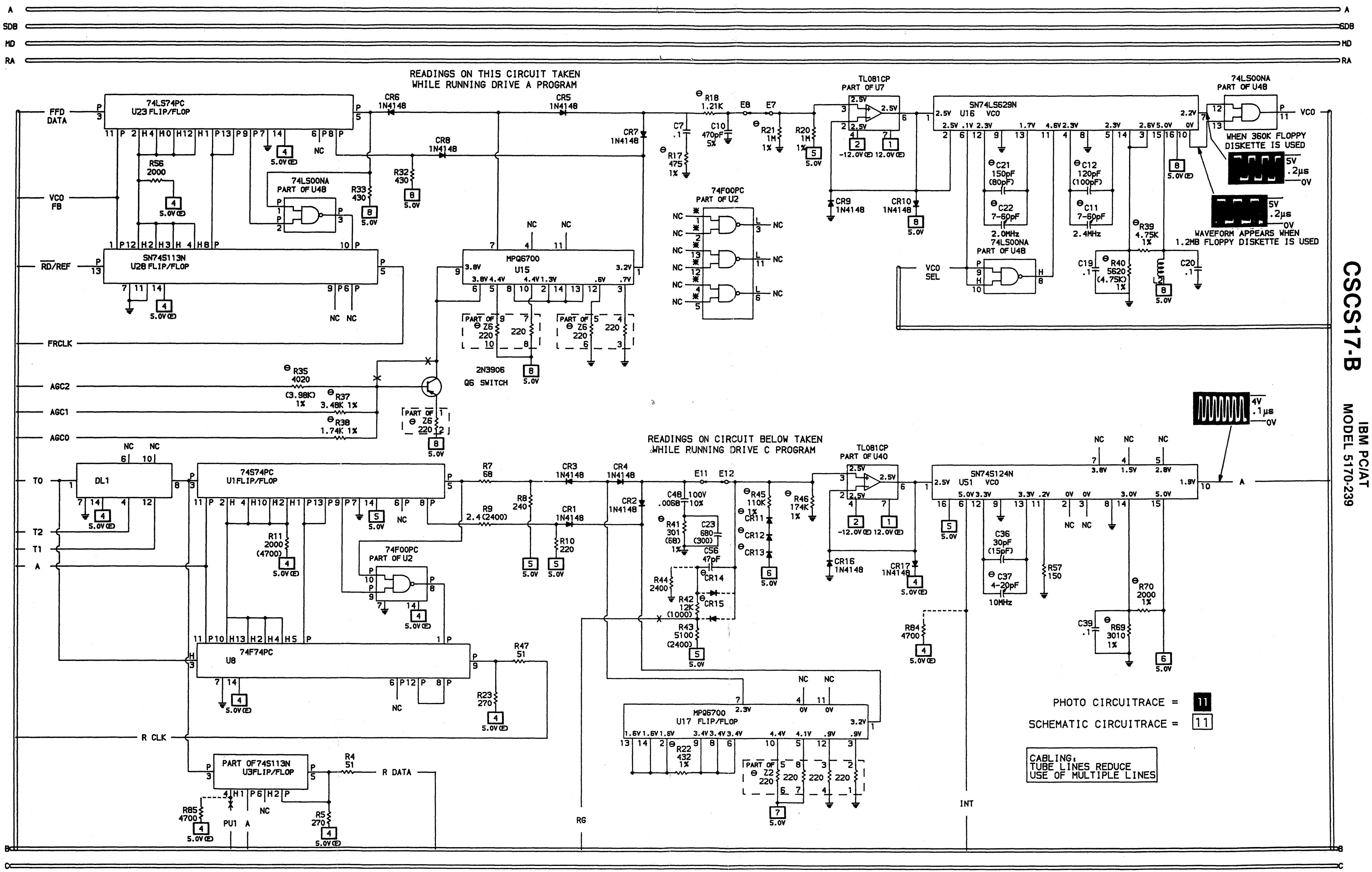
A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE


READINGS ON THIS PAGE TAKEN WHILE RUNNING DRIVE A PROGRAM
A
SDB
MD
RA
B
C
TO COMPUTER
P1 B3
P1 B29
P1 B9
P1 B7
P1 B5
C3, C6, C14, C18, C25 THRU C28, C32, C38, C40, C41, C42, C43, C44, C51 THRU C55 .1
C47 22µF
C33 .1
C45 22µF
C8 .1
R3 10 (8.2)
R2 10 (8.2)
R6 82 (8.2)
78M05HC VR1VOLT REG
9.0V
5.0V
C49 .22
R72 22
C1 2.2µF
C2 .1
C35 .1
L3
L1
C34 .1
C13 .1
R36 120
78M05HC VR2VOLT REG
C17 .22
C16 2.2µF
C50A .1
C9 .1
C24 .1
C46 22µF
R71 430
5.0V SOURCE
12.0V SOURCE
-12.0V SOURCE
READ DATA
SN74LS14N PART OF U22
PART OF Z5 150
SDB0
SDB1
WD2293A-PE U29 CONTROLLER
FREP
LDFCR
MR
VCO
VCO EN
AGC0
AGC1
AGC2
VCO SEL
VCO FB
R29 3300
R26 4700
Q2 2N3906
R49 17.8K 1%
R31 3300
R30 4700
Q3 2N3906
R48 12.7K
Q5 2N3906
R51 105K 1%
R52 17.8K (12.8K) 1%
Q4 2N3906
R27 4700
R28 3300
Q1 2N3906
R50 6190 (6.49K) 1%
R55 17.8K 1%
SN74LS221N U38
C30 150pF
C31 22pF
R67 2430 (2400)
R68 2000 (4700)
NC
RD/RF
RD/REF
FFD DATA
PU2
R/C
PART OF AM26S02PC U27
C29 .1 (820pF)
R54 17.8K
CABLING: TUBE LINES REDUCE USE OF MULTIPLE LINES
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE


A
SDB
MD
RA
FFD DATA
VCO FB
RD/REF
FRCLK
AGC2
AGC1
AGC0
T0
T2
T1
A
R CLK
74LS74PC U23 FLIP/FLOP
SN74S113N U28 FLIP/FLOP
74LS00NA PART OF U48
R56 2000
R33 430
R32 430
CR6 1N4148
CR5 1N4148
CR8 1N4148
CR7 1N4148
MPQ6700 U15
PART OF Z6 220
2N3906 Q6 SWITCH
R35 4020 (3.98K) 1%
R37 3.48K 1%
R38 1.74K 1%
R18 1.21K
E8
E7
C7 .1
C10 470pF 5%
R17 475 1%
R21 1M 1%
R20 1M 1%
74F00PC PART OF U2
TL081CP PART OF U7
CR9 1N4148
CR10 1N4148
SN74LS629N U16 VCO
C21 150pF (80pF)
C22 7-60pF
2.0MHz
C12 120pF (100pF)
C11 7-60pF
2.4MHz
74LS00NA PART OF U48
VCO SEL
R39 4.75K 1%
C19 .1
R40 5620 (4.75K) 1%
C20 .1
74LS00NA PART OF U48
VCO
WHEN 360K FLOPPY DISKETTE IS USED
5V .2µs 0V
WAVEFORM APPEARS WHEN 1.2MB FLOPPY DISKETTE IS USED
4V .1µs 0V
DL1
74S74PC U1 FLIP/FLOP
R11 2000 (4700)
74F00PC PART OF U2
74F74PC U8
R7 68
R9 2.4(2400)
R8 240
CR3 1N4148
CR1 1N4148
R10 220
CR4 1N4148
CR2 1N4148
R47 51
R23 270
E11
E12
C48 .0068 100V 10%
R41 301 (68) 1%
C23 680 (300)
C56 47pF
R44 2400
R42 12K (1000)
R43 5100 (2400)
CR14
CR15
R45 110K 1%
CR11
CR12
CR13
R46 174K 1%
TL081CP PART OF U40
CR16 1N4148
CR17 1N4148
R84 4700
MPQ6700 U17 FLIP/FLOP
R22 432 1%
PART OF Z2 220
SN74S124N U51 VCO
C36 30pF (15pF)
C37 4-20pF
10MHz
R57 150
R70 2000 1%
C39 .1
R69 3010 1%
PART OF 74S113N U3 FLIP/FLOP
R4 51
R DATA
R85 4700
R5 270
PU1
RG
INT
NC
5.0V
-12.0V
12.0V

READINGS ON THIS CIRCUIT TAKEN WHILE RUNNING DRIVE A PROGRAM

READINGS ON CIRCUIT BELOW TAKEN WHILE RUNNING DRIVE C PROGRAM

PHOTO CIRCUITRACE = 11

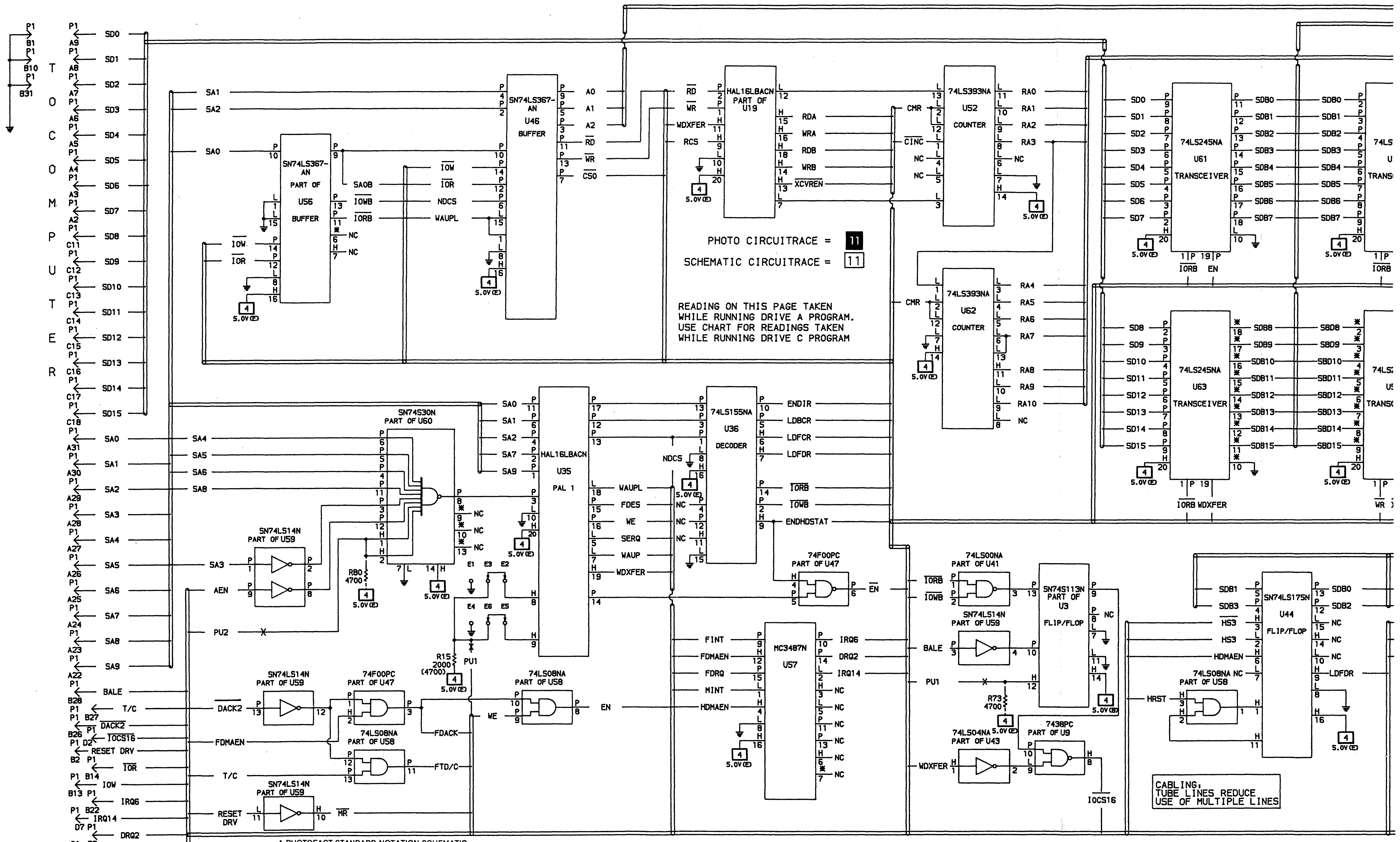
SCHEMATIC CIRCUITRACE = 11

CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES

CSCS17-B

IBM PC/AT
MODEL 5170-239

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE®


TO COMPUTER
P1 A9 SD0
P1 A8 SD1
P1 A7 SD2
P1 A6 SD3
P1 A5 SD4
P1 A4 SD5
P1 A3 SD6
P1 A2 SD7
P1 C11 SD8
P1 C12 SD9
P1 C13 SD10
P1 C14 SD11
P1 C15 SD12
P1 C16 SD13
P1 C17 SD14
P1 C18 SD15
P1 A31 SA0
P1 A30 SA1
P1 A29 SA2
P1 A28 SA3
P1 A27 SA4
P1 A26 SA5
P1 A25 SA6
P1 A24 SA7
P1 A23 SA8
P1 A22 SA9
P1 B28 BALE
P1 B27 T/C
P1 B26 DACK2
P1 D2 IOCS16
B2 RESET DRV
P1 B14 IOR
B13 IOW
P1 B22 IRQ6
D7 IRQ14
P1 B6 DRQ2
A11 AEN
SN74LS367-AN PART OF U56 BUFFER
SN74LS367-AN U46 BUFFER
SA0B
IOWB
IORB
NDCS
WAUPL
A0
A1
A2
RD
WR
CS0
HAL16LBACN PART OF U19
RDA
WRA
RDB
WRB
XCVREN
WDXFER
RCS
74LS393NA U52 COUNTER
CMR
CINC
RA0
RA1
RA2
RA3
74LS393NA U62 COUNTER
RA4
RA5
RA6
RA7
RA8
RA9
RA10
NC
74LS245NA U61 TRANSCEIVER
SDB0
SDB1
SDB2
SDB3
SDB4
SDB5
SDB6
SDB7
74LS245NA U63 TRANSCEIVER
SDB8
SDB9
SDB10
SDB11
SDB12
SDB13
SDB14
SDB15
IORB EN
IORB WDXFER
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
SN74S30N PART OF U60
HAL16LBACN U35 PAL 1
74LS155NA U36 DECODER
ENDIR
LDBCR
LDFCR
LDFDR
ENDHDSTAT
WAUPL
FDES
WE
SERQ
WAUP
WDXFER
SN74LS14N PART OF U59
AEN
PU2
R80 4700
E1 E3 E2
E4 E6 E5
R15 2000 (4700)
PU1
74F00PC PART OF U47
74LS08NA PART OF U58
DACK2
FDMAEN
T/C
FDACK
FTD/C
RESET DRV
MR
EN
MC3487N U57
FINT
FDMAEN
FDRQ
MINT
HDMAEN
IRQ6
DRQ2
IRQ14
74LS00NA PART OF U41
SN74S113N PART OF U3 FLIP/FLOP
BALE
R73 4700
74LS04NA PART OF U43
7438PC PART OF U9
IOCS16
SN74LS175N U44 FLIP/FLOP
HS3
HDMAEN
HRST
5.0V

READING ON THIS PAGE TAKEN WHILE RUNNING DRIVE A PROGRAM. USE CHART FOR READINGS TAKEN WHILE RUNNING DRIVE C PROGRAM

CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES

FIXED DISK/FLOPPY DISK ADAPTER

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE®

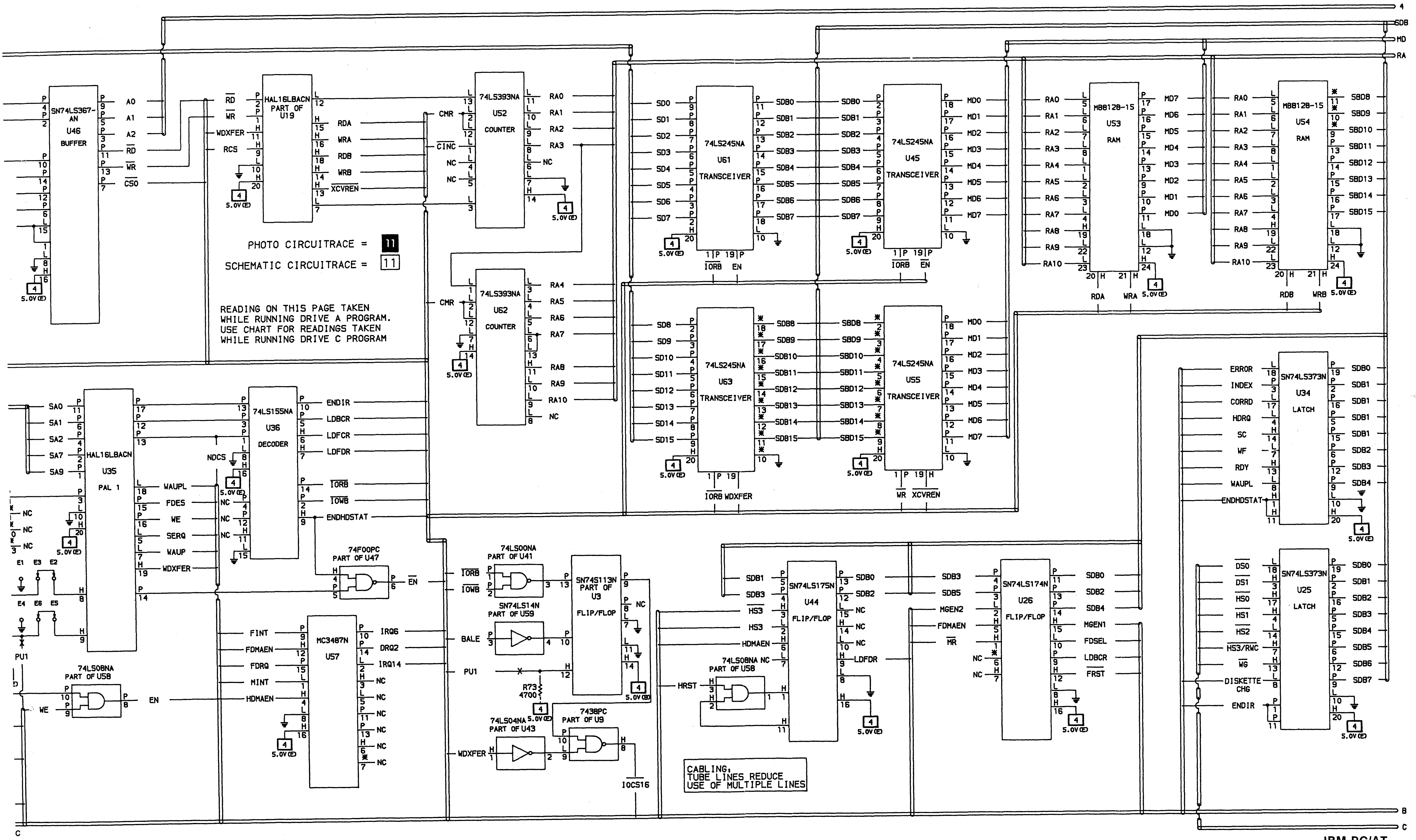

SN74LS367-AN
U46
BUFFER
A0
A1
A2
RD
WR
CS0
HAL16LBACN
PART OF
U19
RD
WR
WDXFER
RCS
RDA
WRA
RDB
WRB
XCVREN
74LS393NA
U52
COUNTER
CMR
CINC
NC
RA0
RA1
RA2
RA3
74LS393NA
U62
COUNTER
RA4
RA5
RA6
RA7
RA8
RA9
RA10
74LS245NA
U61
TRANSCEIVER
SD0
SD1
SD2
SD3
SD4
SD5
SD6
SD7
SDB0
SDB1
SDB2
SDB3
SDB4
SDB5
SDB6
SDB7
IORB
EN
74LS245NA
U45
TRANSCEIVER
MD0
MD1
MD2
MD3
MD4
MD5
MD6
MD7
MB8128-15
U53
RAM
RDA
WRA
MB8128-15
U54
RAM
RDB
WRB
SDB8
SDB9
SDB10
SDB11
SDB12
SDB13
SDB14
SDB15
74LS245NA
U63
TRANSCEIVER
SD8
SD9
SD10
SD11
SD12
SD13
SD14
SD15
IORB WDXFER
74LS245NA
U55
TRANSCEIVER
WR XCVREN
SN74LS373N
U34
LATCH
ERROR
INDEX
CORRD
HDRQ
SC
WF
RDY
WAUPL
ENDHDSTAT
SN74LS373N
U25
LATCH
DS0
DS1
HS0
HS1
HS2
HS3/RWC
WG
DISKETTE CHG
ENDIR
SA0
SA1
SA2
SA7
SA9
HAL16LBACN
U35
PAL 1
WAUPL
FDES
WE
SERQ
WAUP
WDXFER
74LS155NA
U36
DECODER
NDCS
ENDIR
LDBCR
LDFCR
LDFDR
IORB
IOWB
ENDHDSTAT
74F00PC
PART OF U47
EN
74LS08NA
PART OF U58
WE
EN
PU1
E1 E3 E2
E4 E6 E5
MC3487N
U57
FINT
FDMAEN
FDRQ
MINT
HDMAEN
IRQ6
DRQ2
IRQ14
74LS00NA
PART OF U41
IORB
IOWB
SN74LS14N
PART OF U59
BALE
PU1
R73
4700
SN74S113N
PART OF
U3
FLIP/FLOP
74LS04NA
PART OF U43
WDXFER
7438PC
PART OF U9
IOCS16
SN74LS175N
U44
FLIP/FLOP
HS3
HDMAEN
HRST
LDFDR
74LS08NA
PART OF U58
SN74LS174N
U26
FLIP/FLOP
MGEN2
FDMAEN
MR
MGEN1
FDSEL
LDBCR
FRST
5.0V(E)
4
SDB
MD
RA
B
C

PHOTO CIRCUITRACE = 11

SCHEMATIC CIRCUITRACE = 11

READING ON THIS PAGE TAKEN
WHILE RUNNING DRIVE A PROGRAM.
USE CHART FOR READINGS TAKEN
WHILE RUNNING DRIVE C PROGRAM

CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES

FIXED DISK/FLOPPY DISK ADAPTER

IBM PC/AT
MODEL 5170-239

SAMS COMPUTERFACTS™

IBM PC/AT
MODEL 5170-239

ENHANCED GRAPHICS ADAPTER

CSCS17-A
IBM PC/AT
MODEL 5170-239

KEYBOARD, POWER SUPPLY, SERIAL/PARALLEL ADAPTER, SYSTEM BOARD

See Folder CSCS17

FIXED DISK/FLOPPY DISK ADAPTER FLOPPY DISK DRIVE

See Folder CSCS17-B

CSCS17-A
IBM PC/AT
MODEL 5170-239

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COMPUTERFACTS™ put easy to use, informative technical data right at your fingertips. Each edition includes specific service information on the individual component, along with some overall troubleshooting hints.

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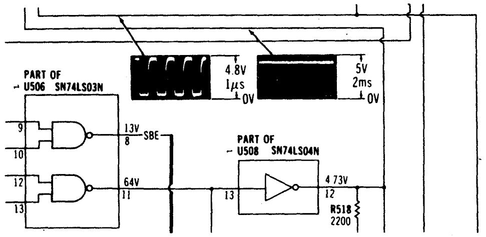
- SAMS famous industry accepted standardized notation schematics containing CIRCUITRACE®, GRIDTRACE™, waveforms, voltages and stage identification.

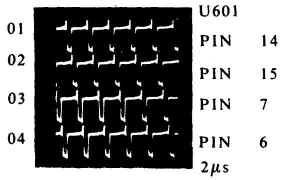


- Step by Step Troubleshooting guides the technician through the ncessary procedures to quickly locate the problem.

TROUBLESHOOTING

MICROPROCESSOR CHIP (CPU) OPERATION

Verify the processor is functioning by checking the signals on the address lines (pins 10 thru 24 of IC U600) and the data lines (pins 41 thru 56) using a logic probe or a scope if a logic probe is used, refer to the "Logic Chart" for the correct readings. If a scope is used, the waveforms on the address lines (except pins 22 and 23 which have no signal in Power Up mode) should be similar to Figure 1. The waveforms on the data lines should be similar to Figure 2.

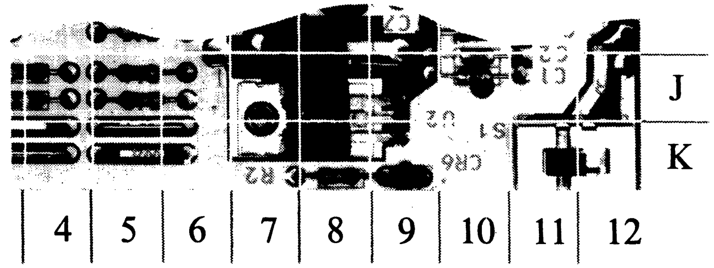


- Logic Chart containing logic probe readings to isolate defective circuitry and components.

LOGIC

PIN NO.	IC U100	PIN NO	IC U100	PIN NO	IC U102	IC U103	IC U104	IC U105	IC U106	IC U107	IC U108	IC U109
1	P	21	P	1	L	L	L	L	L	L	L	L
2	P	22	P	2	P	P	P	P	P	P	P	P

- Quick Component Location using the SAMS exclusive GRIDTRACE, CIRCUITRACE, and component photographs.



- Complete Components Parts List in an easy to use format with field replacements shown when possible. SAMS unique semiconductor, chip and IC cross-reference gives you many replacements to choose from and is available at your Electronic Distributor.

SEMICONDUCTORS (Select replacement for best results)

			REPLACEMENT DATA				
ITEM No.	TYPE No.	MFGR. Part No.	ECG Part No.	NTE Part No.	RCA Part No.	ZENITH Part No.	NOTES
D102	1SS53	1149-2576	ECG519	NTE519	SK9091/177	103-131	
D103	2N60FM	1149-2527	ECG109	NTE109	SK3088	103-Z9001	
D201	1N4004GP	1201-4205	ECG116	NTE116	SK3312	212-76-02	
D501 thru D503	1SS53	1149-2576	ECG519	NTE519	SK9091/177	103-131	

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